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THE INTERNATIONAL SUGAR·JOURNAL

A·TECHNICAL·&·COMMERCIAL PERIODICAL·DEVOTED·ENTIRELY TO·THE·SUGAR·INDUSTRY

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APRIL, 1959

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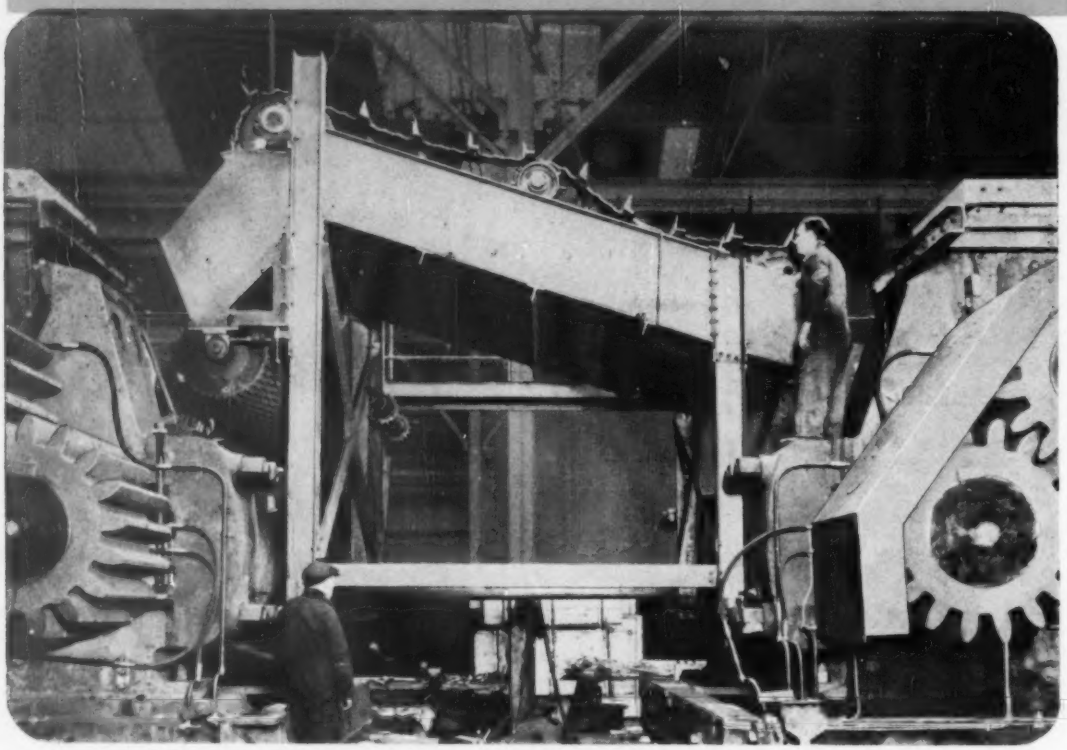

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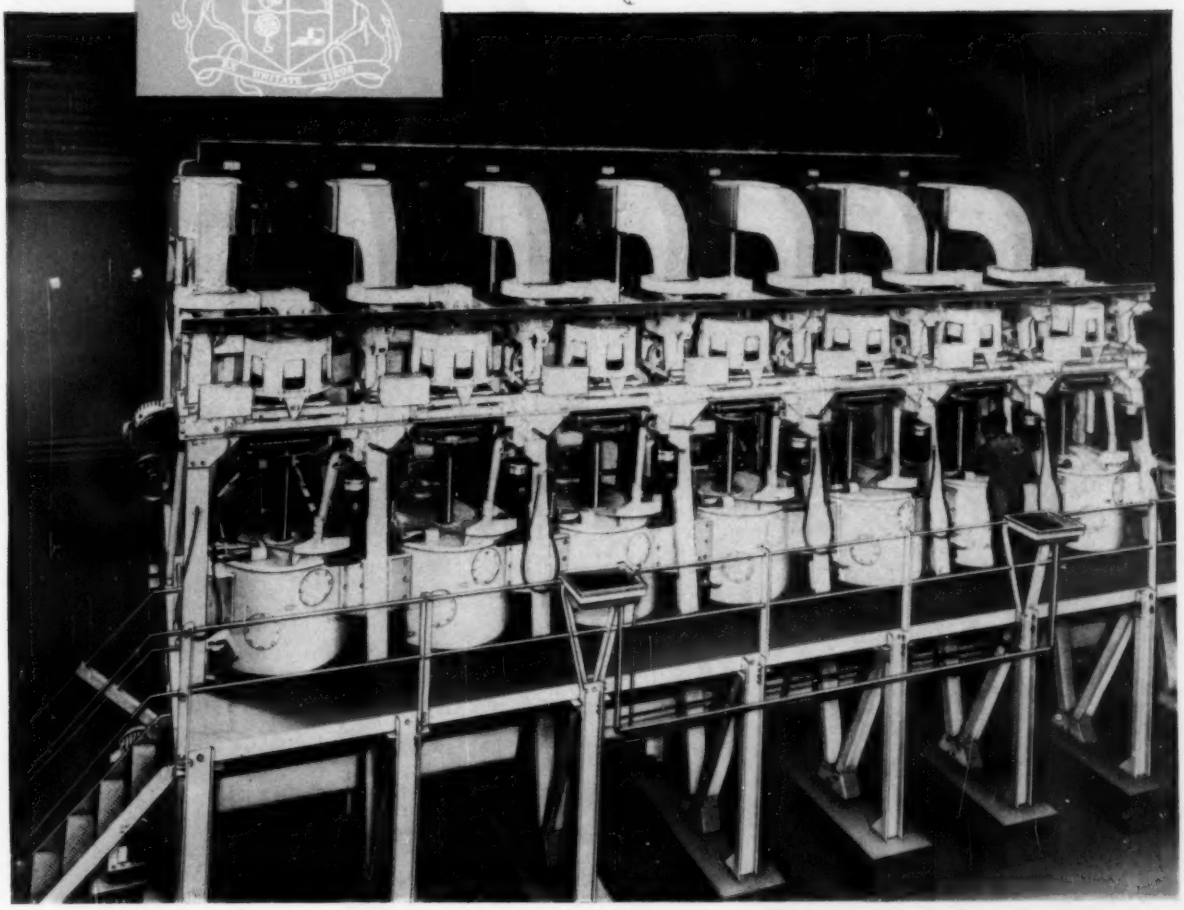

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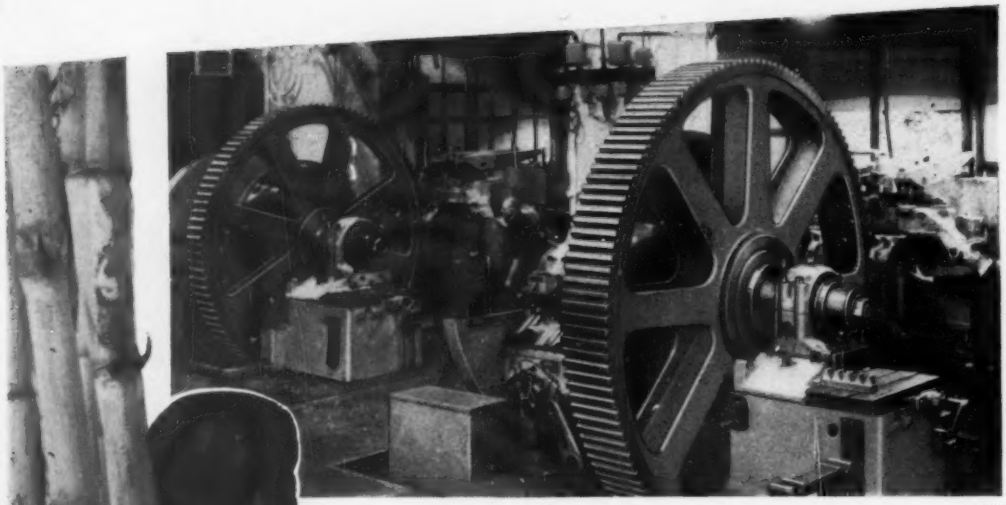

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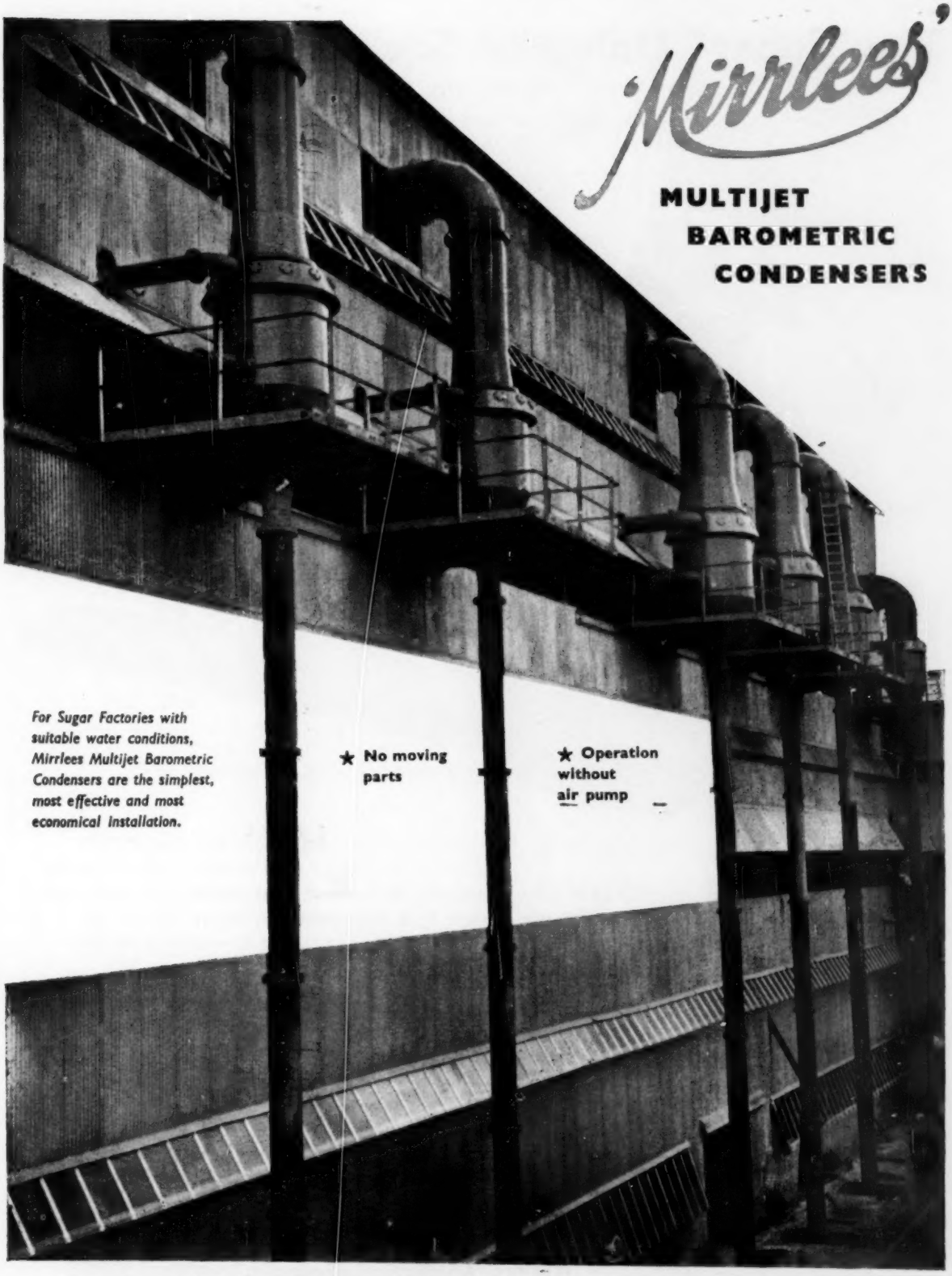

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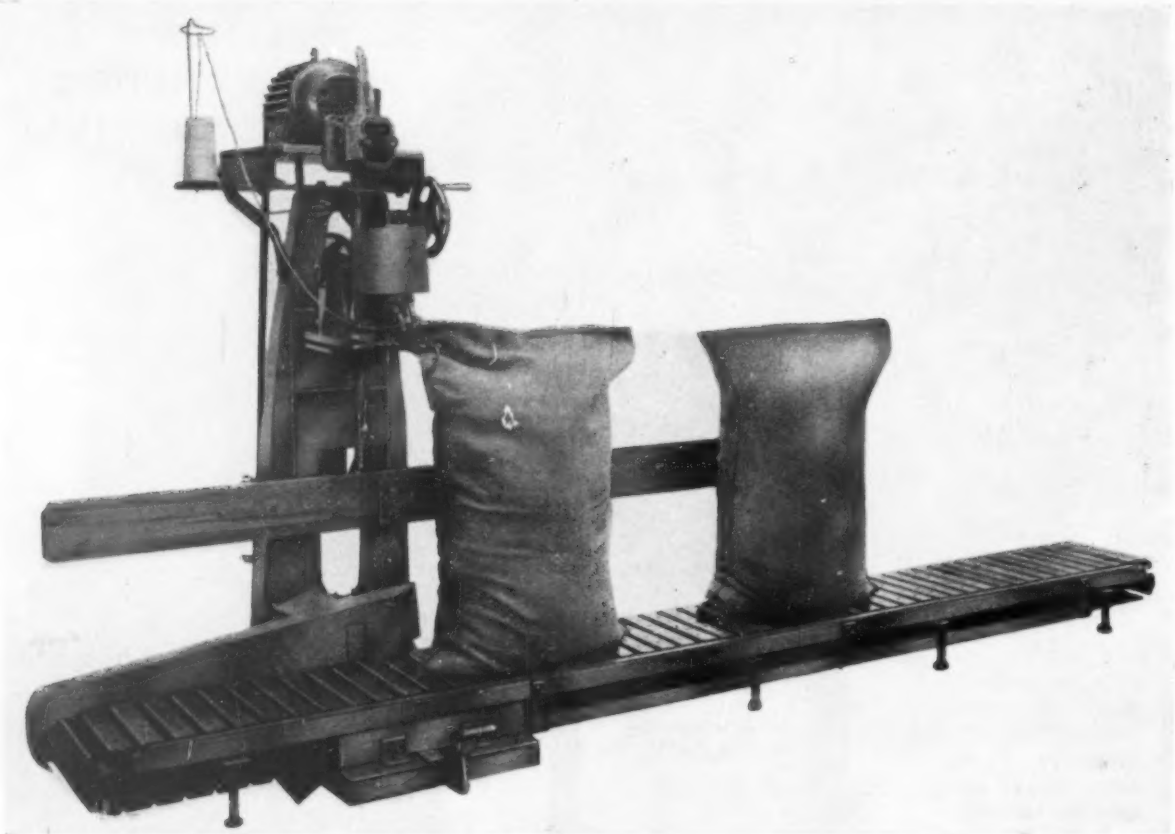

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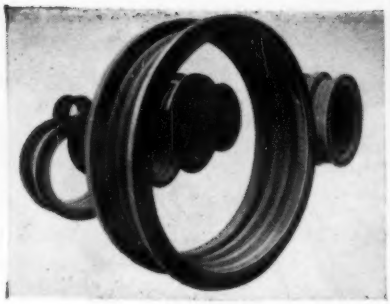

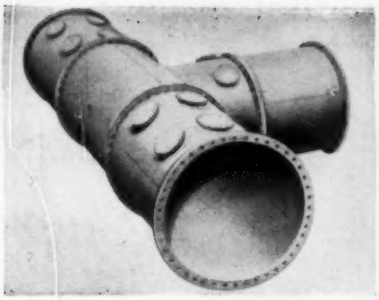

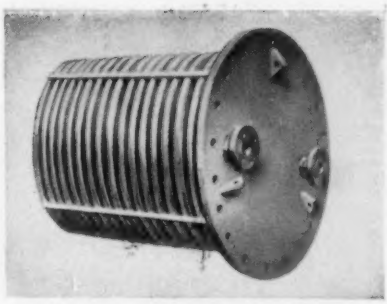

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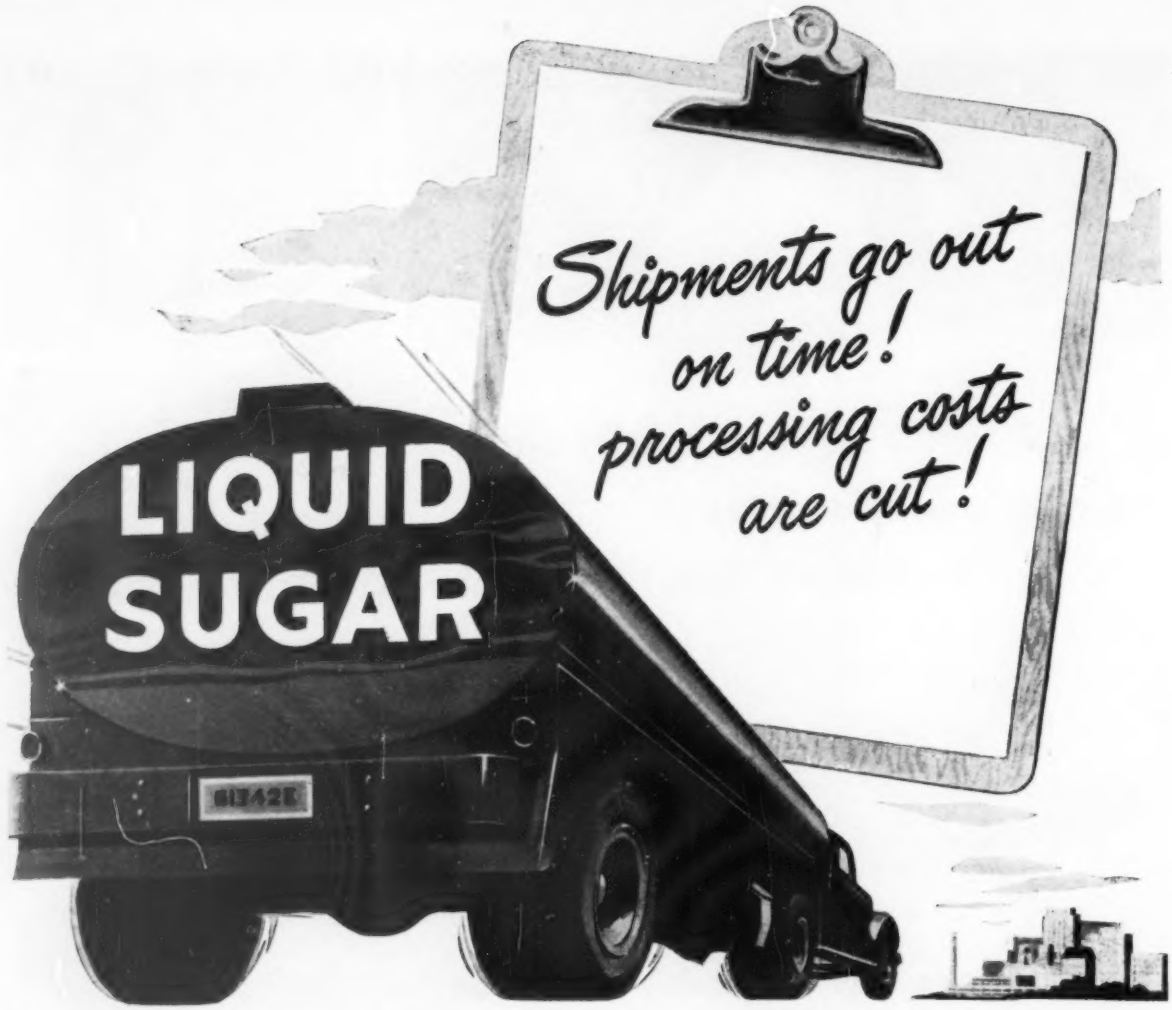

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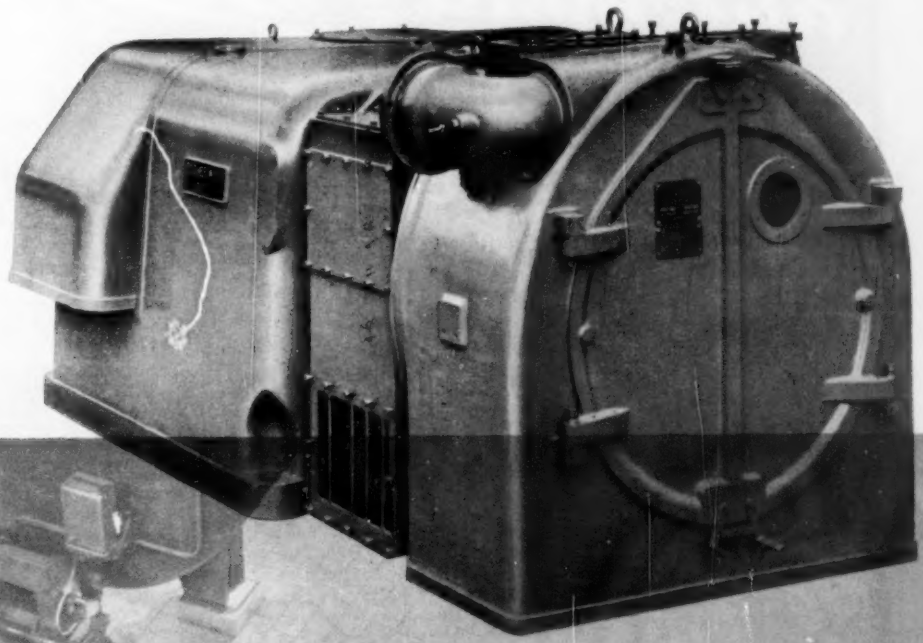

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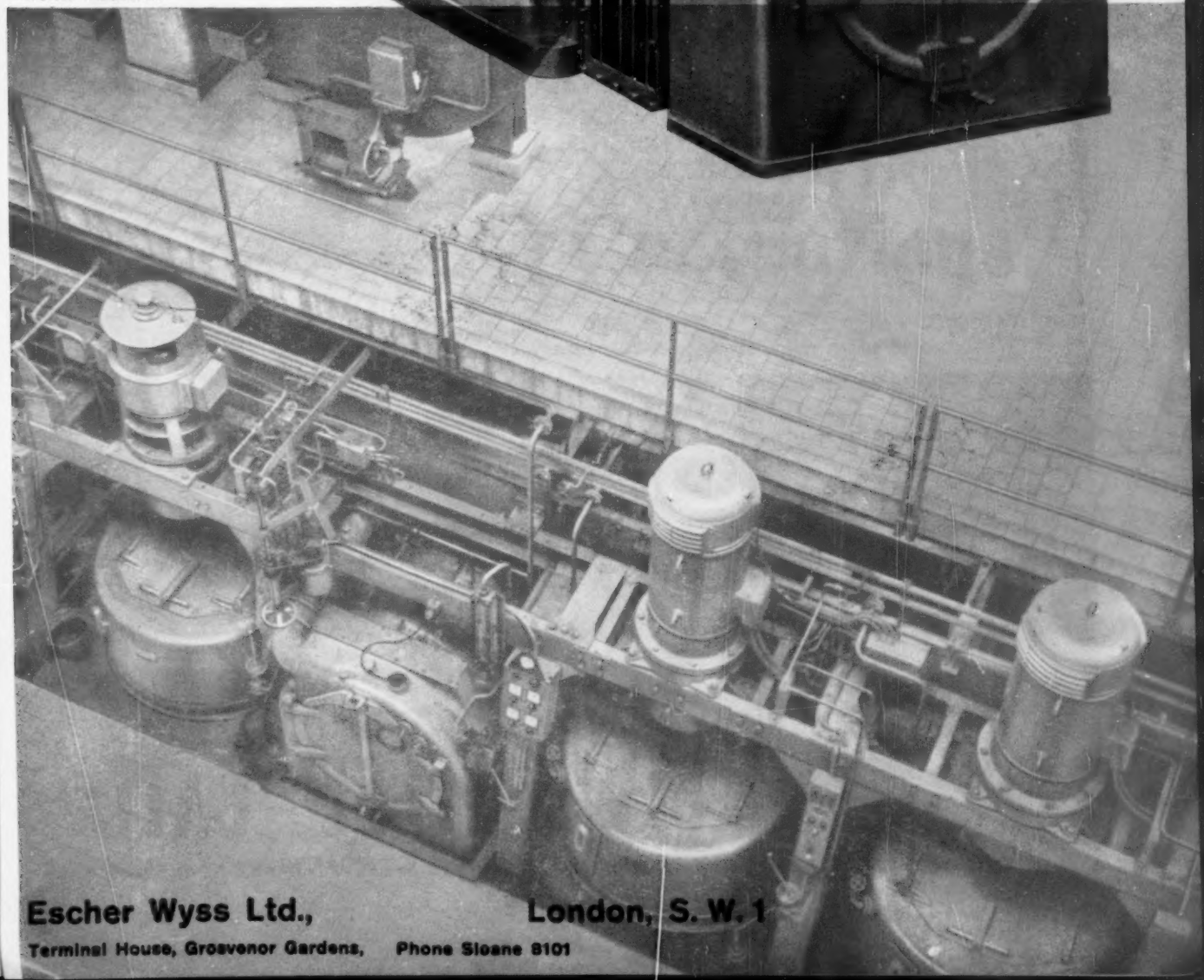

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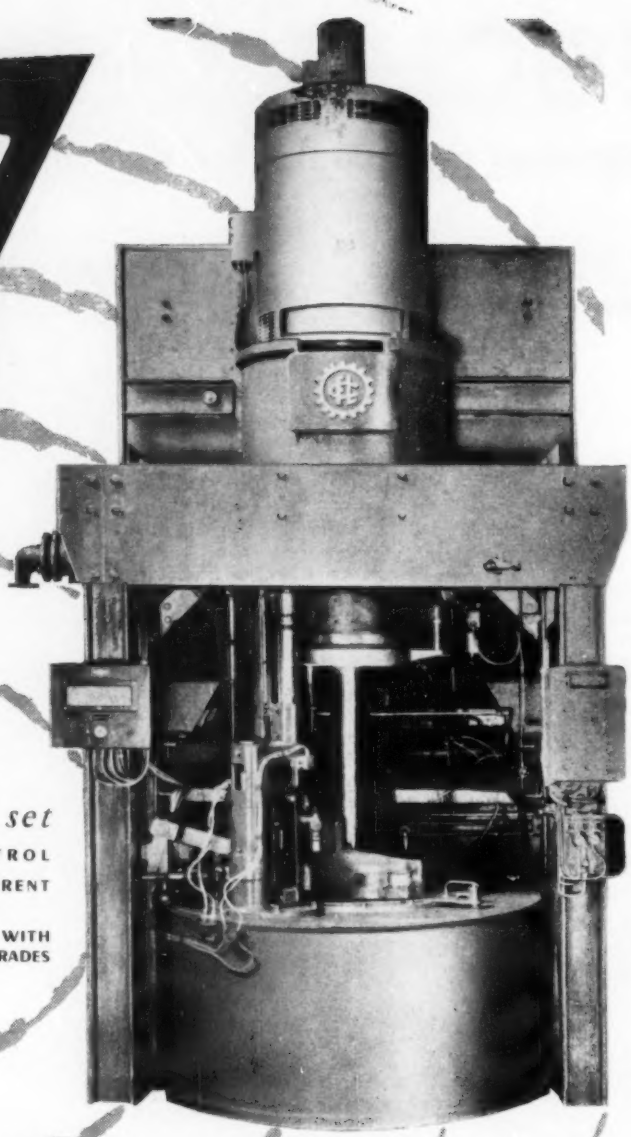

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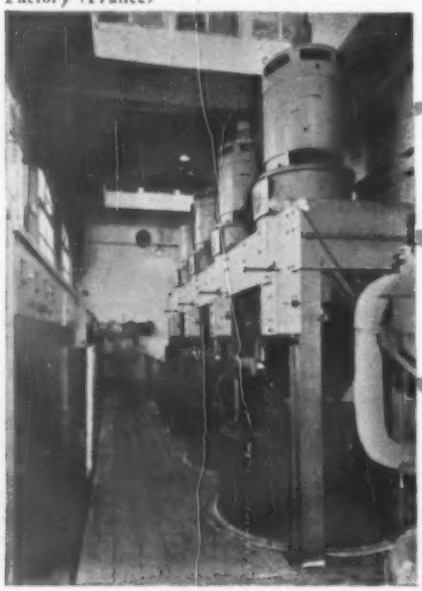

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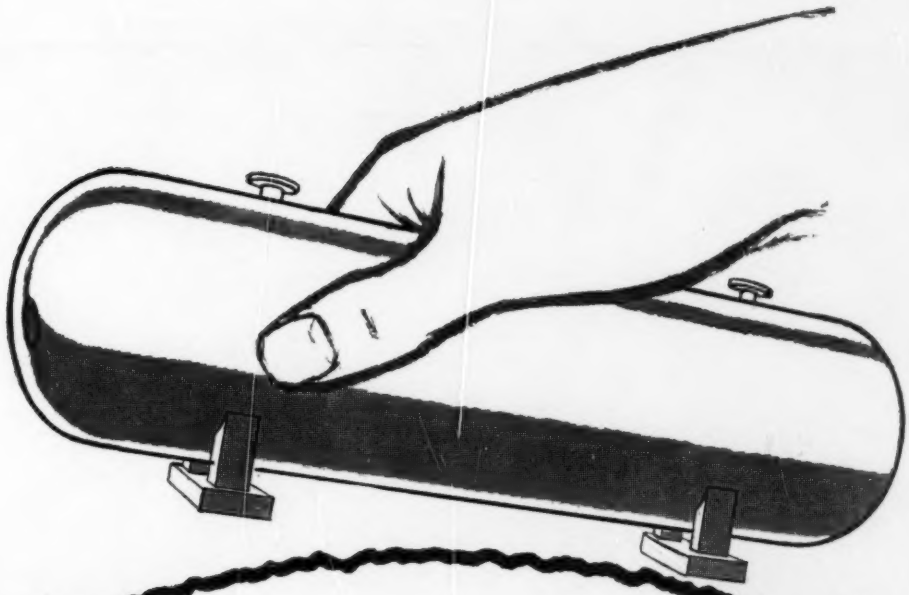

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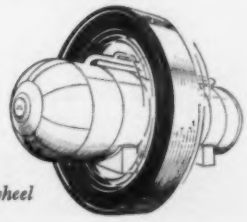

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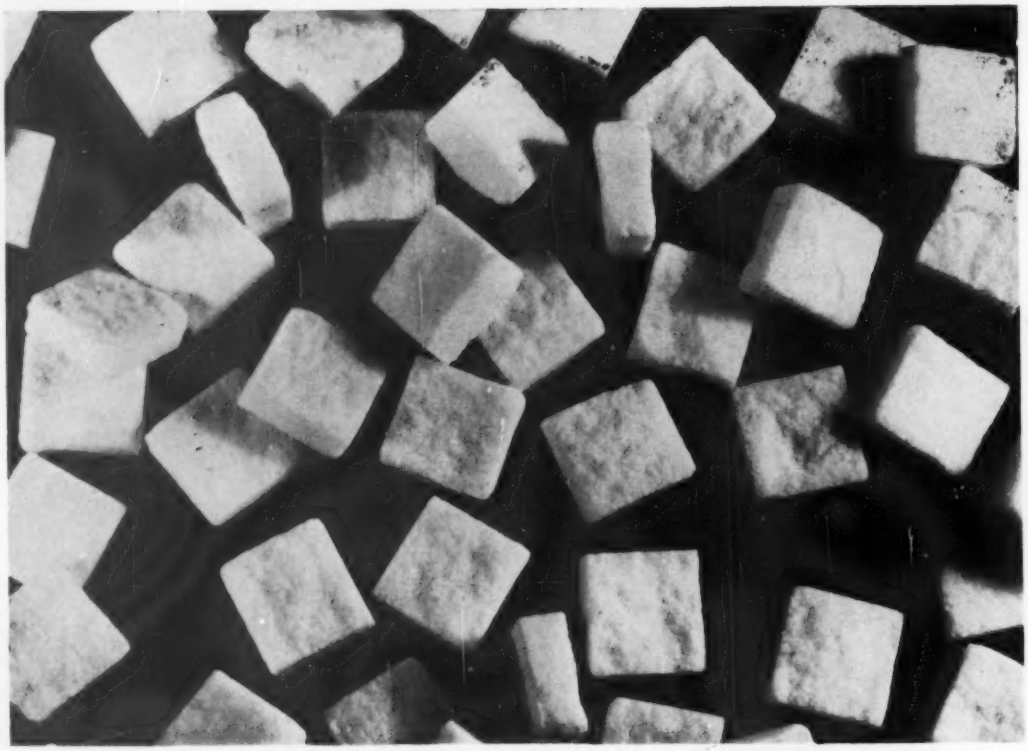

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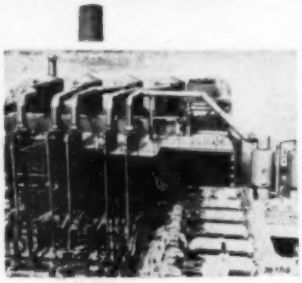

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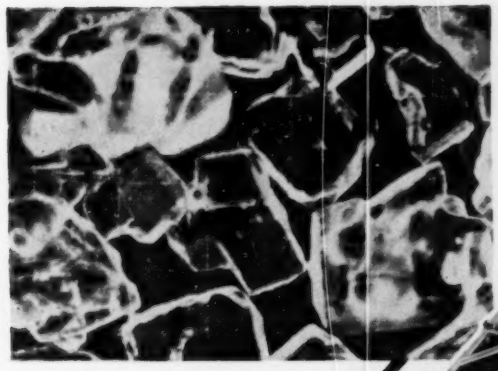

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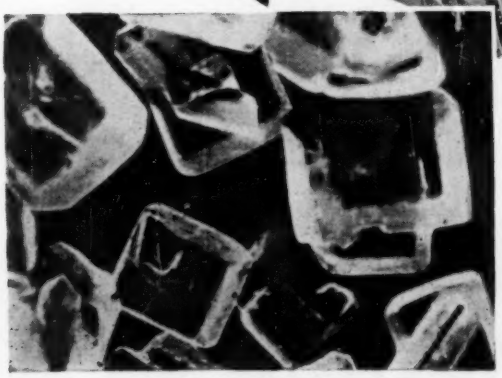

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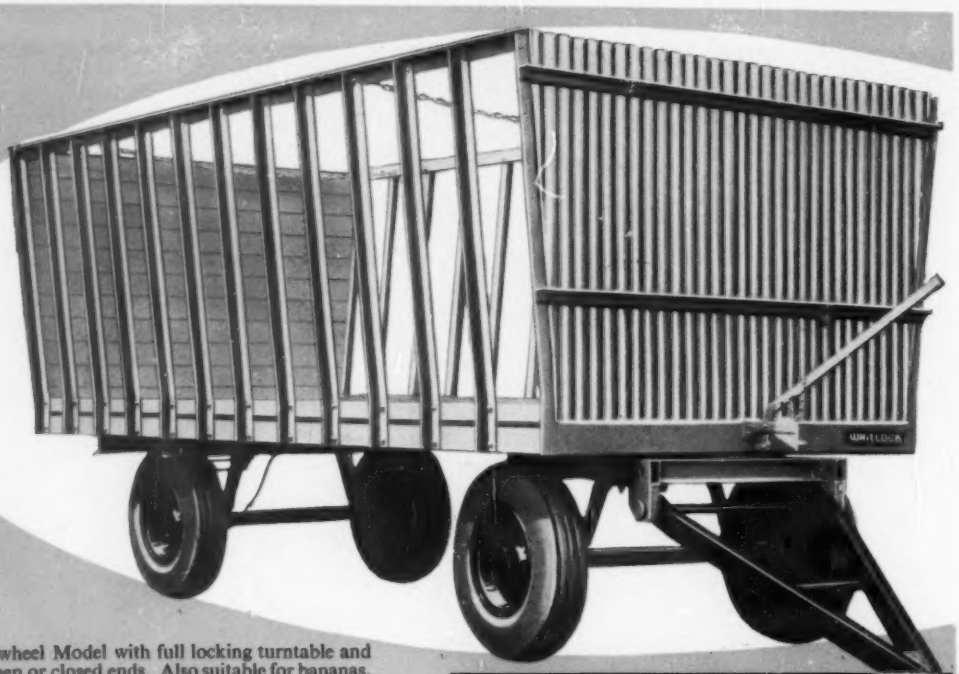

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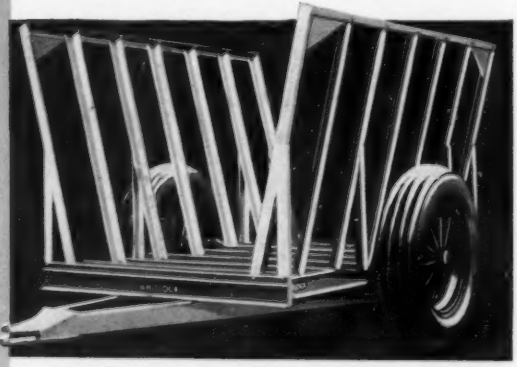

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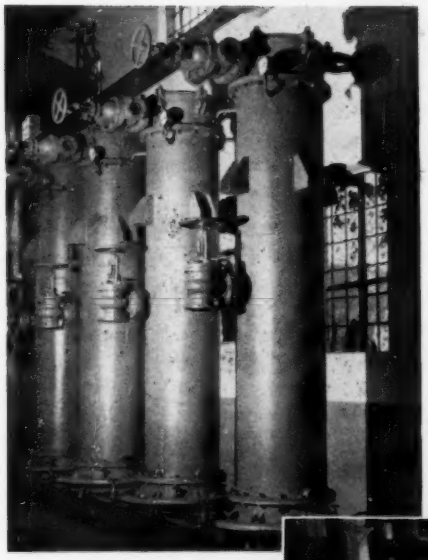

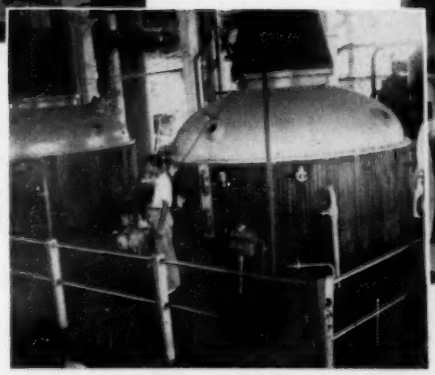

Above: Juice Heaters—Brazil; Right: Vacuum Pans—British Guiana; Extreme Right: Evaporators in one of the British Sugar Corporation Factories.

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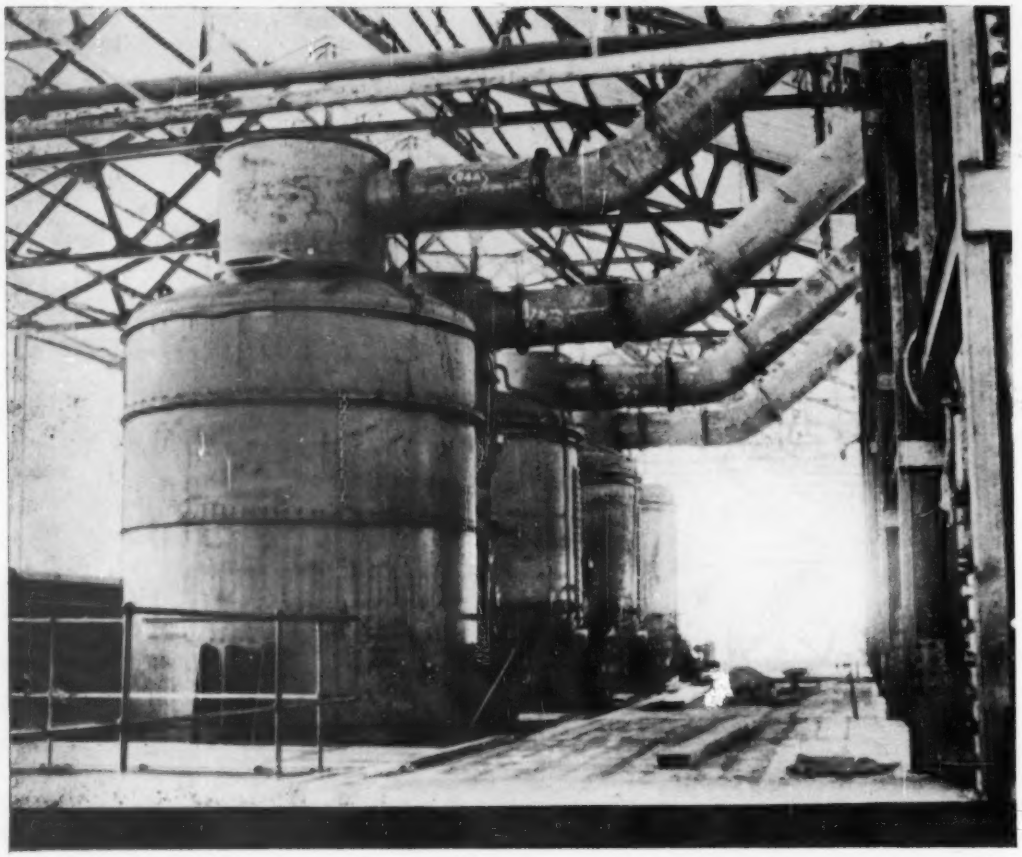

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THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXI APRIL, 1959 No. 724

NOTES AND COMMENTS

International Sugar Council.

The Second Session of the International Sugar Council was held in London on 25th and 26th February 1959 in order to deal with the situation created by the fact that the prevailing price was below 3·25 cents per pound. The Council made a thorough survey of the demand, supply and stock position and concluded that :—

(*a*) The minimum requirements of the free market in 1959 would be of the order of 5,580,000 metric tons.

(*b*) Supplies available to the free market in 1959 from exporting countries outside the Agreement would not exceed 325,000 tons. (The Council could not find in the wide range of information available to it evidence to support any significantly higher estimate).

(*c*) Supplies available to the free market in 1959 from member exporting countries under the various provisions of Article 14 would amount to 6,000,000 tons, prospective shortfalls being estimated at 870,000 tons, of which some 350,000 tons are not subject to redistribution.

(*d*) The substantial stocks of sugar which overhung the market in the period 1952–1956 have disappeared and there is no evidence of any substantial rebuilding.

The Council, therefore, having regard to these factors and with a view to stabilising the price within the agreed range, unanimously decided to take the following action :—

(*a*) To reduce export quotas in effect to 92½% of basic export tonnages.

(*b*) In addition the exports of all participating exporting countries possessing basic export tonnages will be adjusted so as not to release to the market, of their quota in effect, a quantity equal to 10% of their basic export tonnages. This limitation will remain in force so long as market conditions warrant. The Council will review the situation in the light of developments and, in any event, not later than at its next ordinary session to be held in June.

The combined effect of these measures is to reduce export quotas in effect to a level 500,000 tons below that of basic export tonnages and to reduce the supplies available to the market by an additional 650,000 tons, i.e. by 1,150,000 tons in all, pending a further decision by the Council in the light of market conditions.

The Council agreed not to meet again on March 19th as originally planned for the purpose of finally determining the initial export quotas since that action has been taken at the current session. The next ordinary session of the Council will take place in June.

Mr. D. A. BRUCE MARSHALL (Canada) presided over the Session which was attended by delegates of 31 countries and an Observer of F.A.O.

* * *

Sugar Production in the U.S.S.R.

A summary of Mr. KHRUSCHEV's remarks on sugar beet contained in his report to the plenary meeting of the Central Committee of the Communist Party of the Soviet Union on "The Results of the Agricultural Development over the last Five Years and the Problems of a further Increase in Agricultural Production" appeared in "*Izvestia*" of 16th December 1958.

"As a result of measures decided upon in September 1957, the total area planted in sugar beets increased by almost 1 million hectares as against 1953. The crop which amounted to 21 million tons in 1949–53, 31 million tons in 1955, 32·5 million tons in 1956 and to 39·7 million tons in 1957, increased to 54·1 million tons in 1958, i.e. twice the 1953 figure. Thus the production figure planned for 1960 had already been reached in 1958.

"Most of the expansion of planted areas and of yield of sugar beet took place in the Ukraine where the area has increased by 361,000 hectares over the last five years ; sugar beet processing reached a figure of 32 million tons (compared with 16,300,000 tons in 1953) ; and sugar production a figure of 3,600,000 tons as against 2,573,000 tons in 1953.

"Considerable successes were also registered in the Russian Federation. The expansion of the area in sugar beets has also been carried through in the Southern Caucasus and in the adjacent areas.

"These achievements, although remarkable in themselves, are not considered sufficient. Over the next few years, area and crop yield are to be expanded

and improved in order to bring sugar beet production up to at least 70–80 million tons and thus provide for production of 9–10 million tons of sugar for the country. This, it is felt, can best be achieved in the Ukraine, the Central Chernozem area and in the Northern Caucasus—areas which enjoy good climatic conditions, have a dense population with sufficient manpower resources and good experience in sugar beet growing and where, besides the erection of new factories, it is possible to build up the capacity of the existing ones.

"It is considered possible, for instance, to increase by 1965 the area of sugar beet in the Ukraine by some 330,000 hectares (of which 70,000 hectares would be already gained in 1959), thus bringing the total sugar beet area of the Ukraine to 1,660,000 hectares, with a resulting crop of 40 million tons. The crop would be processed mostly in existing factories and mainly on account of the increase in their capacity.

"Several factories in the Ukraine have already increased their production capacity ; some of the most outstanding results being an increase from 1,500 to 3,000 and from 1,200 to 5,000 metric tons per day. Over the next seven years, the total daily processing capacity of the 130 factories now functioning in the Ukraine can be increased by 66,000 metric tons, i.e. one-third of the present capacity. Such increases would be equivalent to the erection of 34 medium-sized sugar factories and would result in the Ukraine producing 5,300,000 tons of sugar in 1965 as against its present production of 3,600,000 tons. The build-up of existing capacity would cost 2,800,000 roubles per 100 tons of increased daily capacity, as against a cost of some 4,000,000, roubles required for new erections. Furthermore, the necessary expansion work can be carried out in between peak periods, whereas the erection of a new factory takes from two to three years. It should not be deduced from this that new factories will not be needed, but they will be required in a lesser number.

"Expansion of area planted will, however, raise problems of labour and here special attention must be given to the mechanization of sugar beet cultivation. Experiments were carried out in 1958 in one of the sugar beet areas, on a planted area of 100,000 hectares, resulting in an average crop increase of 2·4 metric tons per hectare with a saving in manpower of 25% per unit of production. In another larger area, the average crop increase over the last four years was 2·8 metric tons per hectare with substantial saving in manpower. Even a relatively modest figure of 20% saving in manpower per unit of production, and a further mechanizing of sugar beet harvesting would make it possible, in the course of the next few years, to bring sugar production to the level necessary to meet the country's sugar requirements".

* * *

Australian Sugar Production 1958[1].

Production of sugar in Queensland reached 1,352,900 long tons 94 n.t. in the 1958 season which ended when Isis mill finished crushing on January 3rd. This compares with 1,256,271 tons of sugar made in the 1957 season, and was obtained from 9,741,470 tons of cane (8,945,617 tons in 1957). Sugar production in New South Wales was 57,000 tons 94 n.t., from 471,657 tons of cane, compared with 36,841 tons in 1957 from 303,046 tons of cane.

* * *

Indian Sugar Industry Expansion[2].

With the support of the Indian government two sugar consortiums have been established, the task of which is to build up 12 sugar factories. The following firms are members of the first sugar consortium : Walchandnagar Industries, Texmaco and India Sugar and General Engineering Corp., while the second consortium is constituted by K.C.P. Ltd., Binny & Co. and the New India Development Corporation.

At the first meeting it was decided to hand over the first four plants to the associations provided as future proprietors, sufficiently early that they can be put into operation during the 1960/61 campaign. The largest factory is to have a daily processing capacity of 2000 tons of cane, while the initial capacity of the three smaller plants is to amount to 1000–1200 tons. Their daily capacity may later on be raised to 1500 tons. Seven of the other eight factories are also to be property of associations, while one will be a private undertaking. They are to start with the cane crop 1961/62.

The annual production of all 12 factories is estimated at 160,000 tons of sugar. Four of the eleven co-operative factories are to be situated in Andhra, two in Punjab, two in Bombay and one each in Mysore, Orissa and Uttar-Pradesh. The co-operative factories are to be financed by credits from the Industrial Finance Corporation and the State apex co-operative banks and by the governments of the Federal States concerned sharing in the joint-stocks. The total value of all 12 factories amounts to about 110,000,000 rupees, one third of which is earmarked in foreign exchange for imports of turbo-generators and other investment goods and semi-manufactured products, which can not yet be produced in India herself. The Indian Government is prepared to earmark 30 or 35 million rupees for this purpose until 1961/62. After having executed the present orders the two sugar consortiums are to produce the plants for a further eight to twelve factories every year, in order to make India independent of foreign imports of machinery and equipment.

The value of Indian imports of machinery and spares for sugar factories in 1957 was 39,300,000 rupees, 18,100,000 of which fell to the share of the Federal Republic of Germany. During the first nine months of 1958 the imports of machinery and spares rose by more than 50% to 63,200,000 rupees, 48,800,000 of which fell to the share of West Germany. The imports from the Federal Republic have thereby nearly tripled during the first nine months of 1958 as compared with the whole year 1957.

[1] *Australian Sugar J.*, 1959, **50**, 807, 873.
[2] F. O. LICHT, *International Sugar Report*, 1959, **91**, (Supp. 3), 46.

THE "SAN PABLO" SEEDLING VARIETIES OF TUCUMAN

By Dr. WILLIAM E. CROSS

THE "San Pablo" seedling varieties were produced in the years 1948–1950 in the Experimental Farm of the Tucumán Sugar Factories, located in the grounds of the Ingenio San Pablo. As some of them are being cultivated on a commercial scale, it has been thought convenient to publish a brief report on their origin, as well as on the characteristics, and production results, of the most promising of these varieties.

Some of the seed from which these canes were obtained was produced in Tucumán, but by far the greater part was hybrid seed kindly supplied by the Hawaiian Sugar Planters Assoc. Experiment Station, and the United States Department of Agriculture.

Of the seedlings obtained, all those which appeared to be lacking in vigour, or susceptible to disease, were rigorously discarded, and only the really strong and healthy plants were planted out in the experimental field, and given a number. The parentage of these varieties is shown in the following table :—

Country of origin of seed	*Varieties*	*Parentage*
Tucumán	San Pablo 1–9	Tuc. 4832 × ?
Hawaii	San Pablo 10–18, 49–56	H.35–1066 × ?
Hawaii	San Pablo 19–45	H.36–8770 × ?
Hawaii	San Pablo 46–47	H.38–5501 × ?
Hawaii	San Pablo 48	H.32–1063 × ?
Hawaii	San Pablo 57–68, 110–111	H.39–4137 × ?
Hawaii	San Pablo 69–99, 116	H.40–4123 × ?
Hawaii	San Pablo 100–105	H.37–8574 × ?
Hawaii	San Pablo 106–109, 295–298	H.38–6647 × ?
Hawaii	San Pablo 112–114	POJ 2878 × ?
Hawaii	San Pablo 115	H.38–1601 × ?
United States	San Pablo 117–176	C.P.36–13 × C.P.38–34
United States	San Pablo 177–189	F.31–962 × C.P.44–156
United States	San Pablo 190–193	F.31–962 × C.P.27–48
United States	San Pablo 194–250	C.P.36–13 × C.P.1161
United States	San Pablo 251–261	C.P.43–64 × C.P.36–211
United States	San Pablo 262–294	F.31–962 × C.P.27–38
Hawaii	San Pablo 299–300	H.40–4733 × ?
United States	San Pablo 301–315	C.P.30–24 × C.P.34–120 or C.P.44–125

(The data as to the parentage of the canes used in these crosses are given in an appendix to this article).

All these varieties were carefully studied, and those which appeared to be the best were multiplied, so as to obtain sufficient seed-cane to plant in our experimental plots. Here they were tested out in comparison with some of the principal varieties grown commercially in this Province, which were included as "checks". These were the Tuc.1149, Tuc.2680, Tuc.2683, and especially the Tuc.2645, which is considered here as the best of all our varieties.

In these experiments many of the San Pablo varieties surpassed the standard canes, either in cane production or in factory yield, or both. The comparative results with the Tuc.2645, obtained as the average of several crops in the different experiments, are shown in the table on page 100.

From these results we observe that in these experiments several varieties produced more sugar per hectare than the standard Tuc.2645 cane grown in the same plot, these being the San Pablo 46, 49, 79, 160, 163, 258, and 270, of which the San Pablo 46, 79, and 160 have the specially valuable characteristic of being definitely richer in sugar than the check variety. Some other canes were also much richer in sugar than the Tuc.2645, especially the San Pablo 203 and 231, but their production of cane was relatively low, so that their yield of sugar per hectare was much less than that of the standard variety. Some others produced much more cane per hectare than the Tuc.2645, notably the San Pablo 140, 141, 153,251, 252, 255 ,257 and 284, but this was counterbalanced by much lower factory yields, so that they gave definitely less sugar per hectare.

In order to control and perhaps confirm these interesting results, other series of experiments were started with these and other San Pablo varieties, and several of the most promising ones were distributed among the ingenios for them to be tested out in the different zones of the Province. Of these, the San Pablo 46, 49, 160 and 163 are now grown commercially.

A short description of the canes which appear to be better than the standard Tuc.2645 is given as follows :

San Pablo 46. A vigorous cane, with stalks of a whitish green colour and good average diameter. It is practically immune to the smut and to top-rot, and tolerant, though not immune, to mosaic and is rather early ripening and fairly resistant to frost. It can be cultivated as stubble cane for many years, and maintains its high productivity.

San Pablo 49. A strong growing variety, whose stalks are of a light red colour and of average thickness. It appears to be immune to top-rot and highly resistant to mosaic. It is susceptible to the attack of smut, although up to now this disease does not seem to cause any decrease in the production of cane per hectare, which is usually very heavy. Its sugar content is satisfactory, but not especially high. As stubble it continues to give good results for many years.

San Pablo 79. This is a vigorous cane, which grows to a good height and tillers well. The stalks are of

Plot	Variety	Number of crops	Kilos of Cane produced per hectare	Factory yield %	Kilos of sugar produced per hectare
V.19	San Pablo 14	Plant–4th stubble	65,475	8·18	5,353
	San Pablo 42	Plant–4th stubble	80,208	8·17	6,551
	San Pablo 49	Plant–4th stubble	101,349	7·63	7,734
	Tuc. 2645 (check)	Plant–4th stubble	98,379	7·80	7,671
V.25	San Pablo 46	Plant–3rd stubble	78,851	8·61	6,792
	San Pablo 51	Plant–3rd stubble	79,211	6·92	5,483
	San Pablo 65	Plant–3rd stubble	58,613	8·38	4,913
	San Pablo 79	Plant–3rd stubble	79,110	8·15	6,450
	San Pablo 86	Plant–3rd stubble	43,313	8·59	3,719
	San Pablo 96	Plant–3rd stubble	67,534	8·16	5,509
	San Pablo 98	Plant–3rd stubble	52,211	8·47	4,420
	Tuc. 2645 (check)	Plant–3rd stubble	77,749	7·82	6,083
V.27	San Pablo 140	Plant–3rd stubble	93,600	6,80	6,366
	San Pablo 141	Plant–3rd stubble	92,284	7·19	6,635
	San Pablo 146	Plant–3rd stubble	89,370	8·04	7,182
	San Pablo 153	Plant–3rd stubble	91,969	6·72	6,183
	San Pablo 160	Plant–3rd stubble	77,310	10·20	7,885
	San Pablo 163	Plant–3rd stubble	99,191	8·31	8,247
	Tuc. 2645 (check)	Plant–3rd stubble	86,276	8·85	7,633
V.28	San Pablo 174	Plant–3rd stubble	93,420	7·33	6,850
	San Pablo 189	Plant–3rd stubble	63,383	8·97	5,683
	San Pablo 203	Plant–3rd stubble	67,545	10·63	7,180
	San Pablo 231	Plant–3rd stubble	63,450	10·85	6,886
	Tuc. 2645 (check)	Plant–3rd stubble	90,293	8·82	7,965
V.29	San Pablo 251	Plant–3rd stubble	86,400	8·26	7,133
	San Pablo 252	Plant–3rd stubble	82,316	9·20	7,576
	San Pablo 255	Plant–3rd stubble	84,938	8·47	7,191
	San Pablo 257	Plant–3rd stubble	83,678	8·31	6,954
	San Pablo 258	Plant–3rd stubble	115,841	7·58	8,776
	San Pablo 270	Plant–3rd stubble	84,904	9·29	7,887
	San Pablo 284	Plant–3rd stubble	82,811	8·08	6,689
	Tuc. 2645 (check)	Plant–3rd stubble	76,590	10·15	7,774

good girth and of a whitish green colour. It has not been attacked as yet by the top-rot nor by the mosaic disease. At first it seemed to be immune to the smut, but in 1954–1955 it was attacked, although not with much intensity. Continues to give good yields during many stubble years.

San Pablo 160. A good growing cane, whose stalks are light red in colour and of average thickness. It is practically immune to smut and to top-rot, and highly resistant to mosaic. It ripens rather early and has considerable resistance to frost damage. It is not outstanding in production of cane per hectare, but this is more than made up for by its high sugar content, and the high purity of its juices.

San Pablo 163. This is a specially vigorous cane, which grows to a good height and tillers well. Its stalks are of rather more than average thickness and of a light red colour. Up to now it has not been attacked by the mosaic disease nor by the smut or the top-rot. It is fairly resistant to frost. Although its chief characteristic is its heavy growth, its sugar content is satisfactory. It gives good yields for many stubble years.

San Pablo 258. This is a very vigorous and highly productive cane. Its stalks are of a light green colour and rather thick. It is practically immune to the smut, and has not been attacked by mosaic nor by top-rot. It is fairly resistant to frost. Unfortunately it is rather late in ripening, and not very rich in sugar, although it produces more sugar per hectare than most canes because of its heavy tonnage.

San Pablo 270. This is an excellent growing cane, of dark green stalks which are of average thickness. It has not been attacked in an appreciable degree by mosaic or by top-rot. It is not immune to smut, but this disease does not seem to cause any reduction in the yield of cane. It is very resistant to frost. As stubble cane it gives good yields for many years.

APPENDIX

PARENTAGE DATA RELATED TO CANES USED IN THESE CROSSES.

Variety	Parentage
C.P. 670	U.S. 1694 (selfed)
C.P. 726	U.S. 1694 (selfed)
C.P. 1161	C.P. 670 × ?
C.P. 1165	C.P. 670 × ?
C.P. 27–108	P.O.J. 2364 × C.P. 726
C.P. 34–120	Co. 281 × P.O.J. 2878
C.P. 36–13	P.O.J. 2725 × *Sorghum durra* (?)
F. 31–962	Co. 281 × C.P. 27–108
H. 109	Lahaina × ?
H. 240	D. 1135 × ?
H. 456	H. 240 × ?
H. 9811	Badila × ?
H. 25C–14	Yellow Caledonia × H. 109
H. 26C–270	Yellow Caledonia × H. 109
H. 27–3840	Badila × H. 456
H. 27–8101	H. 25C–14 × Badila
H. 28–4399	Uba (Hawaii) × H. 456
H. 28–4898	Uba (Hawaii) × H. 456
H. 31–626	H. 28–4898 × P.O.J. 2878
H. 31–1389	P.O.J. 2878 × H. 26C–270

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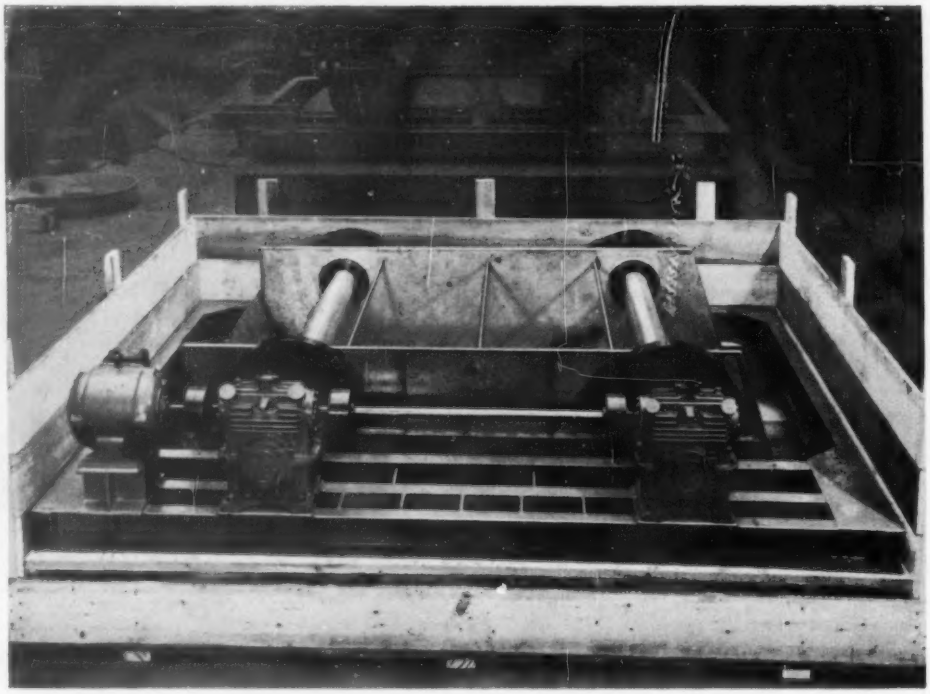

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Variety	*Parentage*
H. 31–2806	P.O.J. 2878 × H. 9811
H. 32–1063	P.O.J. 2878 × H. 28–4399
H. 32–6043	H. 26C–270 × *Saccharum robustum*
H. 32–7054	P.O.J. 2883 × Molokai 1178
H. 32–7406	Lahaina × Molokai 1183
H. 32–8560	Co. 213 × P.O.J. 2878
H. 32–9093	Lahaina × Molokai 1302
H. 32–9791	U.D. 110 × P.O.J. 2878
H. 33–6989	H. 27–8101 × H. 32–9093
H. 33–7021	K. 202 × H. 32–7054
H. 34–1696	P.O.J. 2883 × H. 32–7406
H. 34–2412	H. 27–3840 × H. 32–6043
H. 35–1066	H. 33–7021 × Co. 290
H. 36–8770	H. 34–2412 × ?
H. 37–8574	H. 31–1389 × H. 33–6989
H. 38–1601	H. 31–2806 × ?
H. 38–5501	H. 32–8560 × ?
H. 38–6647	H. 27–8101 × H. 34–1696
H. 39–4137	H. 32–8560 × H. 32–1063
H. 40–4123	H. 32–1063 × ?
H. 40–4733	H. 32–9791 × ?
K. 202	D. 1135 × ?
Molokai 1178	*Saccharum robustum*
Molokai 1183	*Saccharum robustum*
Molokai 1302	*Saccharum robustum*
Tuc. 4832	H. 31–626 × Co. 205
U.D. 110	Uba × D. 1135
U.S. 1694	P.O.J. 213 × ?

AGRICULTURAL ABSTRACTS

Cane Farm Irrigation. N. J. KING. *Australian Sugar J.*, 1958, **50**, 326–327.—The article, originally published in the Brisbane "Courier-Mail", describes the possibilities of irrigation, particularly in such areas as Bundaberg, where rainfall is unreliable. Dams across gulleys can retain a considerable volume of water for later use and where surface water is deficient and pumping expensive, spray irrigation, through economy of water used, justifies the relatively high initial capital cost.

* * *

Unusual Damage to Cane. A. A. MATTHEWS, R.W.M., and E. H. FOX. *Cane Growers' Quarterly Bull.*, 1958, **22**, 40, 41 and 49.—The three separate communications describe the extensive damage done by cockatoos in the Proserpine area and the effectiveness of a carbide gun calibrated to fire every 10 minutes. Reference is also made to damage by cassowaries, a protected bird, and the naked-tailed rat, *Uromys caudimaculatus*.

* * *

Beetle Damage in the South. C. L. TOOHEY. *Cane Growers' Quarterly Bull.*, 1958, **22**, 60, 61.—The unusual damage done in S. Queensland during the 1957 planting season is traced primarily to two shoot-eating beetles, *Metanastes vulgivagus* and *Heteronychus sanctate-helene*, of which a brief description and outline of the injury is given. A third beetle, feeding at the punctures of the two former, is *Ataenius duplopunctatus*.

* * *

Better Pre-emergence Weedicides—At a Price. A. G. BARRIE. *Cane Growers' Quarterly Bull.*, 1958, **22**, 47, 48.—CMU is the most effective compared with 2,4-D and MCPA, but their relative prices at 4 lb/acre are £17 14s 1d, £2 8s 6d and £4 9s 6d.

* * *

Sugar Cane Insects in the Rio Turbio Valley. I. The Borers. P. GUAGLIUMI. *Bol. Esta. Exp. Occidente* (Venezuela), 1957, (66), 48pp.—The Bulletin devotes the first 8 pages to an exposition of the situation of the Valley and its ecology. The subsequent pages cover the biology and ecology of the genus *Diatraea*, the identification of the species occurring, the methods adopted for measuring the degree of infestation and the various species of hyper-parasites, with especial reference to the Amazon fly as a means of control of the borer.

* * *

The Nitrogen Requirements of Sugar Cane in Mysore. K. LAKSHMINARAYANA and B. T. NARAYANAN. *Ind. J. Agric. Sci.* 1957, **27**, (4), 427.—The results of nitrogen manurial trials with sugar cane on three different experimental stations in Mysore are reported. The nitrogen requirements of sugar cane in Mysore is considered to be fairly high and varies from 300 lb of N at Babbur Farm to 400–450 lb at V.C. Farm. The response to nitrogen is influenced both by the dose and the form in which it is supplied. Nitrogen supplied wholly in the organic form (oil-cake and compost) is inferior to ammonium sulphate, but mixtures containing not less than 50% of the total N in the inorganic form are quite as good as wholly organic nitrogen. For routine practice, a basal application of green manure and compost, equivalent to 100 lb N per acre, followed by oil-cake and ammonium sulphate in equal proportions to make up the balance, is recommended. Application of nitrogen at levels higher than 500 lb per acre tend to depress sugar content. No significant interaction between nitrogen treatment and varieties was observed.

* * *

Sugar Beet Yellows in Great Britain, 1957. R. HULL. *Plant Pathology* 1958, **7**, (4), 131.—This troublesome virus disease developed unusually early in 1957 and caused severe losses, especially in the south eastern districts where an average of 75% of plants had yellows by the end of August, compared with less than 20% for the Midlands, Yorkshire and Scotland. In 148 fields sampled by the staff of the British Sugar Corporation, an average of 2·2, 23·6, 42·5 and 56·8 per cent of plants had yellows at the end of June, July, August and September respectively. Yellows followed the early and heavy infestation of crops by green aphids (*Myzus persicae* and *Myzus ascalonicus*) which had lived through the mild winter on weeds and brassica crops.

THE SUGAR CANE IN CUBA

REPORT OF THE 30TH ANNUAL CONFERENCE, ASSOCIATION OF SUGAR TECHNOLOGISTS OF CUBA, 1956.

A BRIEF review only can be given of the various agricultural papers presented to the Conference and now published in the recently issued Report.

Experience in clearing land for cultivation by a heavy chain drawn by two tractors, and the advantages of the system are described by E. ROBAU CASALS. In two papers ROBERTO BARRETO DOMÍNGUEZ records experiments harvested in 1956 and dealing respectively with ammonium nitrate and liquid ammonia. In the former case, there is a significant difference at the 5% level between the control and the 1·5 ton/cab* dressing and thereafter insignificant increases for each additional 0·5 ton up to 3 tons, at which rate the increase is significant at the 1% level. Corrected for sugar recovery the significance at the 1% level appears at the 2 tons per cab dressing. No such regularity is found with liquid ammonia, where the matter is complicated by considerations of depth at which application is made but, at 10 inches, a significant increase at the 1% level was obtained in sugar per caballería with the 2000 lb N/cab dressing followed, however, by a considerable drop in yield for higher dressings. The same author sets out the results of varietal trials conducted in the same year and covering first and second ratoons. The distribution of fertilizer in liquid form is likely to be uneven under the diminishing head of liquid in the container ; to overcome this difficulty a machine has been developed which feeds under a constant head and is described by F. ALZOLA.

Irrigation is dealt with by A. MACARI who records six years experience with overhead irrigation. Under this system, water is pumped from channels through 6-inch aluminium pipes 20 feet in length and light enough to be readily transportable. The distributors are adjustable to different heights. A further means of supplying water to cane, by the artificial production of rain, is described by A. J. LAMB. Since 1951, a series of 58 trials have been made with results ranging from no increase (7), 0–40% increase (34), 41–80% increase (13), 81–100% increase (2) and over 100% (2).

Under pests and their control, C. B. CUETO R. describes further progress in the control of *Diatraea saccharalis* by the Cuban fly, *Lixophaga diatraeae*, using the method, earlier described by him[1], for raising pupae of the former. In view of the growing recognition of the damage done by nematodes to sugar cane, the detailed study given by F. PINEDA will be of interest. The body of the work is devoted to describing the various species involved and the question of control is only lightly touched upon. As a herbicide, "Dowpon" (sodium salt of 2,2-dichloropropionic acid) has been tried in Cuba for the first time and its efficiency is the subject of a paper by K. C. BARRONS.

On the economic side, that of estate management, J. L. FIOL presents two papers. In the first he analyses the differing recoveries for the individual loading derricks and compares the figures for three harvests. The objective is to encourage production of quality among the colonos. In the second, the cost of haulage by rail is analysed.

Lastly, R. FERNÁNDEZ A. describes the various uses to which the field refractometer has been put in Central Mercedes.

H. M.-L.

AGRICULTURAL ABSTRACTS

Investigations about the Transmission of Leaf Scald. H. L. HONG. *Proefsta. voor der Java-Suikerindustrie*, 1958, (1), 1–11. (Indonesian with English summary).—Experiments in several countries have indicated that leaf scald (*Bacterium albilineans*) is mainly transmitted by diseased setts or the knife. The evidence given here suggests that infection may take place through the soil via root wounds such as are caused by rats, though the pathogen does not seem able to survive in the soil over a lengthy period.

* * *

Side Loader Handles 400 Tons a Day. ANON. *S. African Sugar J.*, 1958, **42**, 563.—Five illustrations are given of a loader developed by the Tongaat Sugar Co. Its capacity is 90 tons a day or 20,000 tons per season. Cost, including tractor and pair of trailers, is £2,000.

* * *

Water Disposal by Irrigation. ANON. *S. African Sugar J.*, 1958, **42**, 659, 661.—The Tongaat Sugar Company now disposes of all its factory effluent by spraying it from a storage reservoir. The system, of which the advantages are here described, is adapted from that introduced by the Hanover Canning Co., Pa., with the primary object of preventing pollution of streams.

* * *

Recent Progress in Stunting Disease in Taiwan. H. T. CHU and K. C. LING. *Taiwan Sugar*, 1958, **5**, (1), 26–31.—N:Co 310, now occupying some 95% of the total cane acreage, appears to be particularly susceptible to stunting disease. A description is given of the system introduced in 1954 involving annual hot water treatment of setts and the multiplication from these, through nurseries, of planting material for the total area together with the supervisory organization.

* 1 caballería = 33⅓ acres approx.

[1] *I.S.J.*, 1956, **58**, 60.

THE ESTIMATION OF CALCIUM IN SUGAR FACTORY PRODUCTS BY MEANS OF THE FLAME PHOTOMETER

By ROBERT CAROLAN (Chief Research Chemist, The Irish Sugar Co. Ltd.)

Introduction

CALCIUM is easily estimated in syrups by EDTA titration. In some cases interference is experienced due to traces of heavy metals, and inhibitors have to be used. Very often dilution is a sufficient remedy. When a number of samples have to be tested for potassium and sodium as well as calcium, it is convenient to do all three analyses by means of the flame photometer. Whereas the determination of the alkali metals is straightforward, particularly at low dilutions, calcium estimations are subject to various interferences, and allowances must be made for those due to sugar, potassium, sulphates and phosphates. The latter are not present to any appreciable extent in beet syrups. In the analysis of roots or leaves the K, Na and Ca are determined by flame photometry in the diluted Kjeldahl digest of which aliquots are also used for estimation of N, P and Mg.[1,2]. In this case the sulphate interferes but not the phosphate. At first sight this seems to disagree with the results of various workers who have dealt with phosphate interference and found it to be worse than sulphate interference. It is known, too, that the interference is worse in a cooler flame, and HEMINGWAY[3] states that the *EEL* flame photometer cannot be used for the determination of calcium in biological material owing to phosphate interference, which does not reach a maximum as it does in acetylene-burning instruments, when sufficient phosphate is added. When using such instruments, therefore, phosphate interference can be compensated for by adding excess phosphate to the standards[4]. Notwithstanding these findings HUTTON & NYE[2] were able to estimate Ca in plant digests ("wet ashing" with H_2SO_4) without phosphate interference although they used the *EEL* instrument. It was confirmed in the writer's laboratory that there was also no interference with the Beckman D. U. instrument. HUTTON & NYE (*loc. cit.*) attribute the lack of interference to the low level of P, but according to the experiments to be described later no interference was found with very high concentrations of P, which, according to ADAMS and ROUSE[5], were enough to cause serious interference even with the acetylene-oxygen flame, and to produce a drop of over 80% in the hydrogen-oxygen flame. A simple explanation accounts for these inconsistencies. Phosphates and sulphates both reduce the calcium emission but phosphates have a much greater effect. In the presence of excess sulphate, however, as occurs when Kjeldahl digestions are analysed, the error is not additive. The effect is the same as if no phosphate were present. Moreover a much smaller amount of sulphates than that found in the diluted digests is sufficient to produce maximum interference. This can, therefore, readily be allowed for by adding an excess of ammonium sulphate to the calcium standards. The quantities of K and Na present in beet roots and leaves were not sufficient to interfere.

In the analysis of syrups the quantity of calcium is much lower in relation to potassium and sodium, and the former particularly interferes, as also does sugar. This is allowed for by appropriate additions to the standards. The interference caused by sugar and potassium together is greater than the sum of their individual interferences[6]. It was found in analysing very dilute molasses that this applied even when the sugar alone was insufficient to cause any interference.

White sugar was tested in 10% solution[7]. At this concentration the viscosity slightly lowered the K and Na values, whereas in 2% sucrose they are increased[8]; nevertheless the calcium emission is increased. Similar results were found by GEE *et al*[6]. but SCHNEIDER *et al.*[7] found a decrease, as did HELENA ZAORSKA[9]. These results are undoubtedly due to the use of different instruments. Cation-free sugar for preparation of standards for white sugar analysis was obtained by ion exchange.

The estimation of soluble calcium in beet and raw juice after clarification with lead subacetate was considered. Although lead acetate in slight excess does not interfere with K or Na estimations, it increases the Ca reading. Too little lead acetate also causes too high a reading, probably owing to protein interference. The method was not considered promising. BROWNE & WOOD[10] determine total Ca after extraction of beet pulp with acetic acid. This method may be liable to error due to phosphate interference.

Apparatus

The results to be described were obtained using a BECKMAN D.U. Photometer with Flame Attachment number 9200 for oxy-acetylene and blue phototube. It is important to note that interference effects depend on the type of equipment, particularly the kind of

[1] CAVELL : *J. Sci. Food Agric.*, 1954, **5**, 195.
[2] HUTTON & NYE : *J. Sci. Food Agric.*, 1958, **9**, 7.
[3] *Analyst*, 1956, **81**, 164.
[4] LEYTON : *Analyst*, 1954, **79**, 497.
[5] *Soil Sci.*, 1957, **83**, 305.
[6] GEE *et al.* : *Anal. Chem.*, 1954, **26**, 1487.
[7] SCHNEIDER *et al.*: *Zucker Beiheft*, 1957, **3**, 75.
[8] CAROLAN : *I.S.J.*, 1954, **56**, 189.
[9] *Sbornik Cukrovornicko-Reparské Konference v Praze*, 1955, [1957], 869.
[10] *Proc. Amer. Soc. Sugar Beet Tech.*, 1952, 316.

flame used. This explains many apparent inconsistencies in the literature. For example potassium increases sodium emission in the oxy-acetylene flame but decreased it in the gas and air flame used by BERRY *et al.*[11]. The case of calcium and sugar has already been mentioned.

ESTIMATION OF CALCIUM IN BEET[1, 2]

An experiment was carried out to determine what effect the excess sulphate in the Kjeldahl digest would have on the calcium emission. The wavelength 554 was found to be slightly preferable to 622. The following figures were obtained where the transmission for 20 p.p.m. Ca without sulphate is taken as 100 (Table 1), the water blank being deducted.

TABLE 1

TRANSMISSION VALUE OF 20 p.p.m. Ca IN PRESENCE OF EXCESS SULPHATE

% *Ammonium Sulphate*	% *Transmission*
Nil	100
0·03%	81
0·30	84
3·00	81

The maximum depression (of about 16—19%) occurs at a concentration of sulphate much below that in the diluted Kjeldahl digest.

Table 2 shows further results in experiments using sulphate and phosphate separately and combined.

TABLE 2

EFFECT OF SO_4 AND PO_4 SEPARATELY AND COMBINED ON Ca EMISSION

Ca	Water Solution		Solution in Neutralized 2% H_2SO_4	
p.p.m.	No P	100 p.p.m. P	No P	100 p.p.m. P
20	100	74	89	81
40	100	63	89	94
40	100	—	85	87

In further tests a 26% depression at 80 p.p.m. level for Ca and 50% at the 400 p.p.m. level was found when excess sulphate was present. In the latter case the presence of 540 p.p.m. P in addition did not cause any further decrease in the calcium emission. From all these results it can be seen that at the 20 to 40 p.p.m. Ca level excess sulphate causes a depression of between 11 to 19%; the variations can be attributed to experimental error. The addition of *P* even up to 540 p.p.m. has no further effect; the differences between the last two columns in Table 2 are due to experimental error. On the average the decrease in Table 2 is 12% with sulphate either alone or with phosphate. With phosphate alone the depression is much greater, viz. 37% at the 40 p.p.m. level.

CHEN and TORIBARA[12] found that when all other variables are held constant the calibration of the flame photometer is linear with respect to calcium content. This is true for small quantities of calcium, but the results described above and also those of CHOW and THOMPSON[13] show that the calibration curve is non-linear when a wider range of calcium standards is taken with a fixed amount of sulphate or phosphate. It is shown in agreement with the work of BAKER and JOHNSON[14], using the same instrument that when an excess of sulphate is present phosphate causes no further interference. They also found that when excess phosphate is present, sulphate causes no further interference.

A mixed solution containing excess sulphate and known amounts of K, Na and P, viz. 60, 24 and 22 p.p.m. together with 20 p.p.m. Ca was tested. The Ca found was 20 p.p.m. The same result was found when the phosphate was omitted. It appears, therefore, that amounts of K, Na and P similar to those found in the diluted digest do not interfere with the calcium estimation.

The method used, therefore, was as follows: Digest 2 g dried rasped beet with 30 ml H_2SO_4 and 0·3 grams of a 2 : 1 mixture of selenium and graphite. After 2 hours cool and dilute to 250 ml. Take 25 ml in a 100 ml flask and neutralize with about 6 ml concentrated ammonia followed by dilute ammonia added dropwise with methyl red as indicator. The standard consists of a 40 p.p.m. solution of Ca as chloride prepared from "Analar"-grade $CaCO_3$ and HCl and containing in addition about 5% of "Analar" ammonium sulphate. The water blank need not contain sulphate. The calibration between zero (water blank) and 40 p.p.m. Ca may be considered linear. High water blanks, greater than 30, may be due to a dirty burner. Carbon may be removed from the tip with the finger nail. Strong HCl may then be aspirated followed by plenty of water. The blank is at the best very variable (from about 15–25 as a rule provided the burner is not dirty or choked), as it includes flame background, which is high. Check the blank, therefore, after every sample. About one third of the H_2SO_4 is volatilized during the Kjeldahl digestion; therefore, the amount in the diluted solution used for the flame test is roughly equivalent to 5 g ammonium sulphate.

ESTIMATION OF CALCIUM IN SYRUPS AND JUICES

Molasses is diluted to 0·6 g per 100 ml. At this concentration the sugar does not interfere with the flame photometry of K or Na but it does increase the Ca emission and the blank. Potash also has these effects and the two combined may produce a greater effect than would be expected from their individual effects as is seen from Table 3. The 622 mμ wavelength was used as it gave slightly less background than 544 mμ in presence of sugar.

TABLE 3

EFFECT OF SUGAR, K AND Na ON CALCIUM EMISSION

Sugar %	Instrument set to 100° with following solutions: Ca	K	Na (Parts per Million)	Corresponding reading of 40 p.p.m. Ca in plain water
0·15	40	0	0	100
0·15	40	150	0	87
0	40	150	0	97
0·30	40	0	0	95
0·30	40	150	0	86
0·30	40	150	16	86
0·30	40	0	40	93
0·30	40	300	0	84
0·30	40	300	80	82
0	40	300	0	91
0	40	0	80	93

[11] *Anal. Chem.*, 1946, **18**, 19.
[12] *Anal. Chem.*, 1953, **25**, 1642.
[13] *Anal. Chem.*, 1955, **27**, 910.
[14] *Anal. Chem.*, 1954, **26**, 465.

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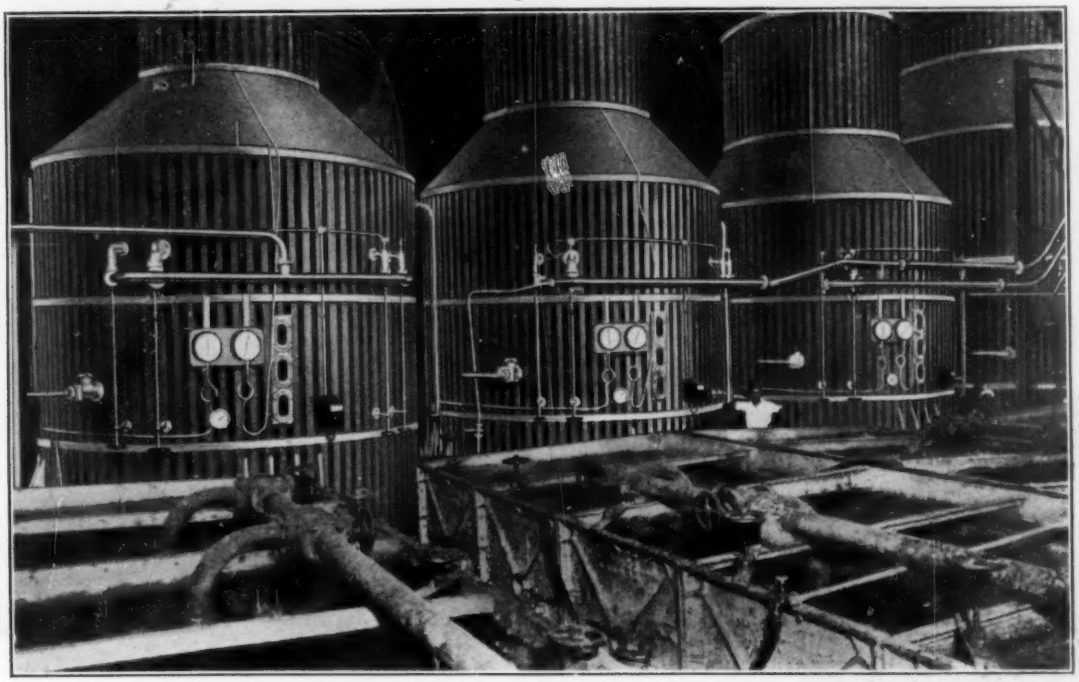

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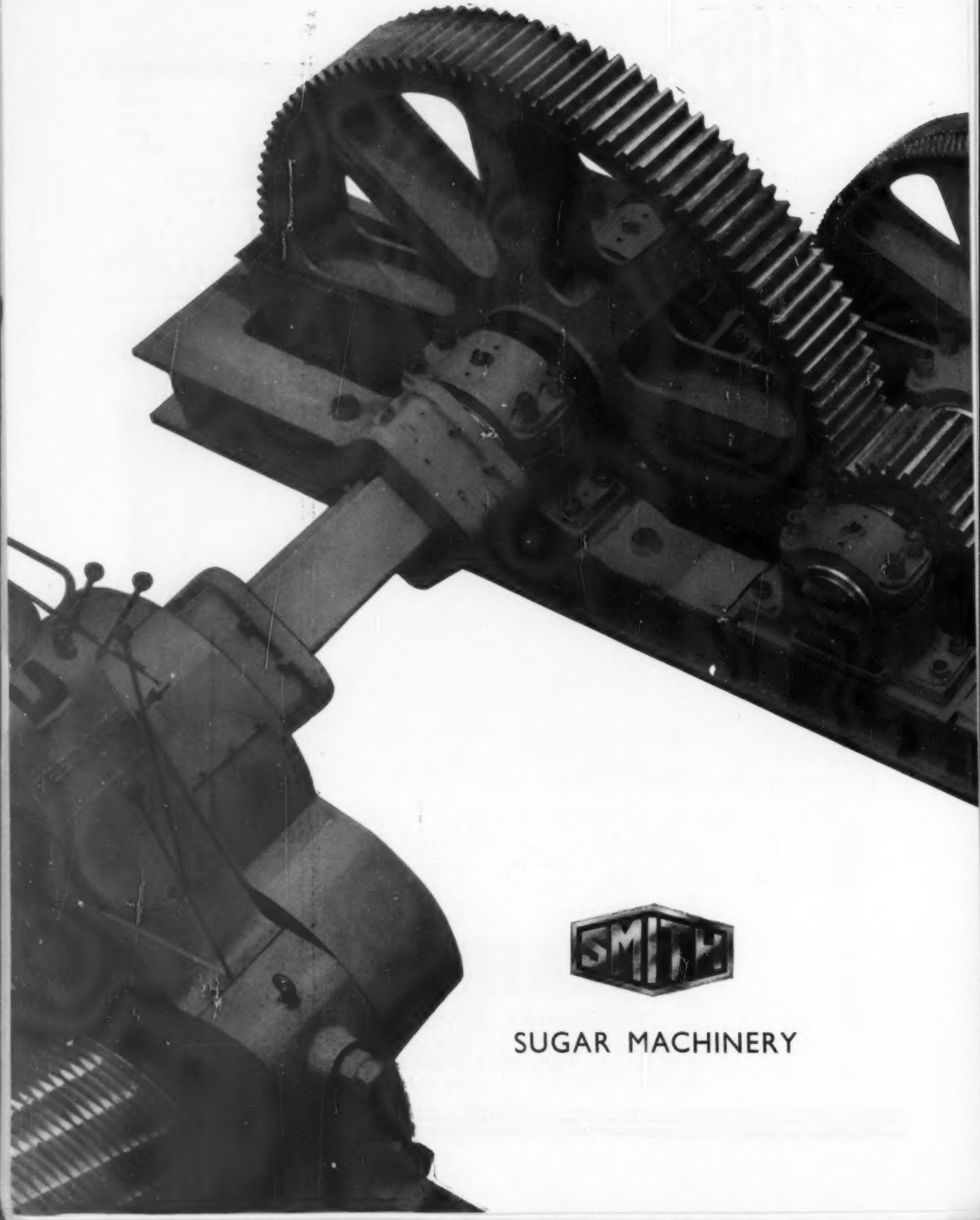

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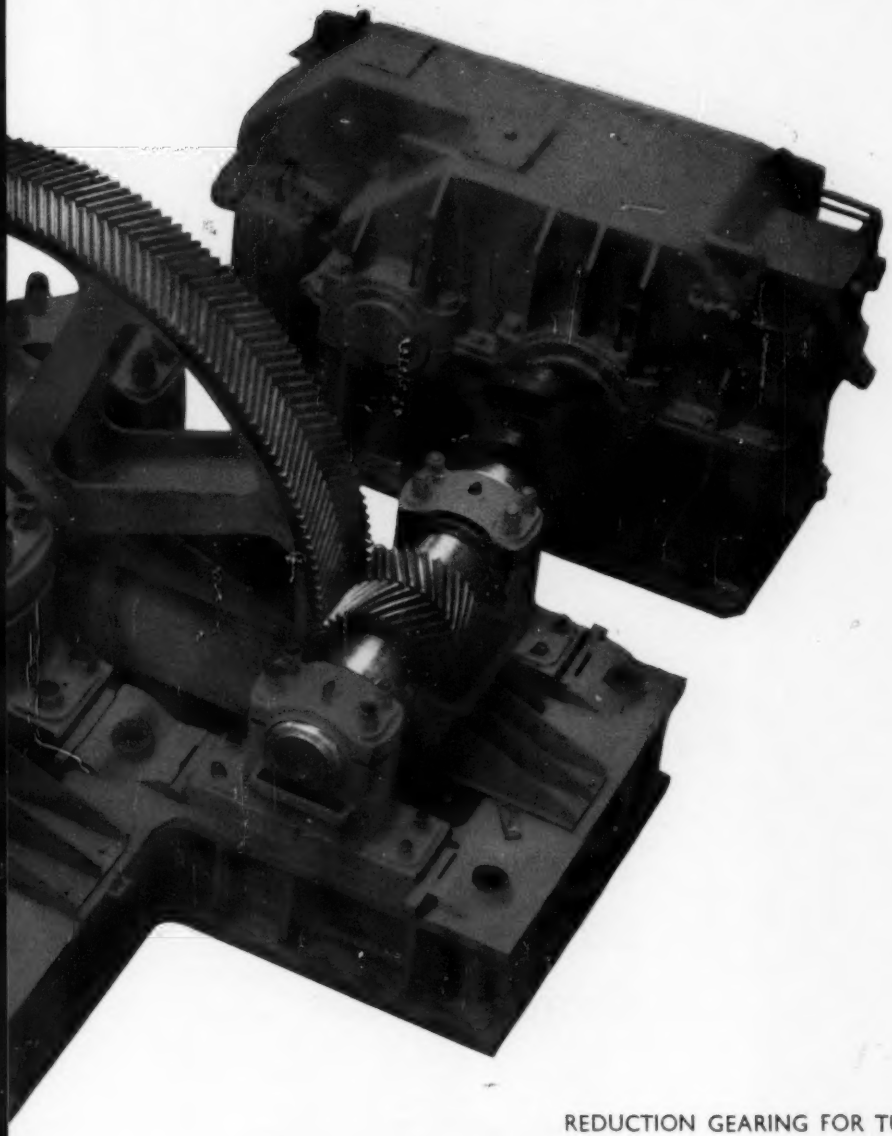

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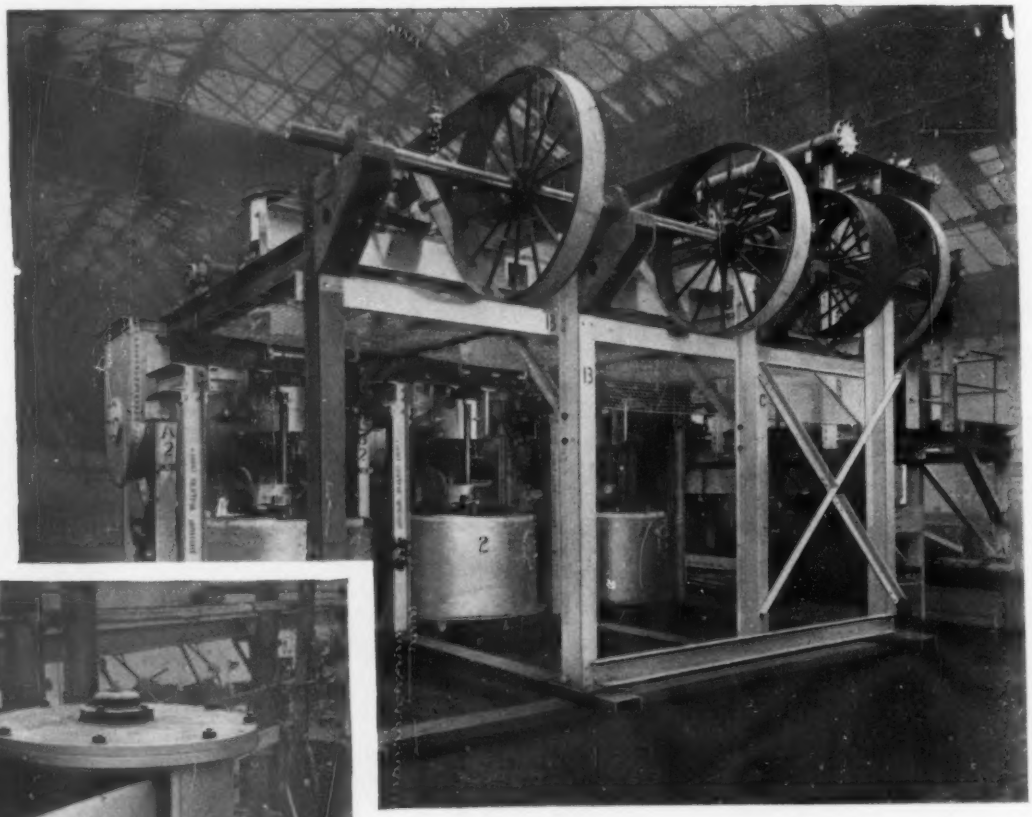

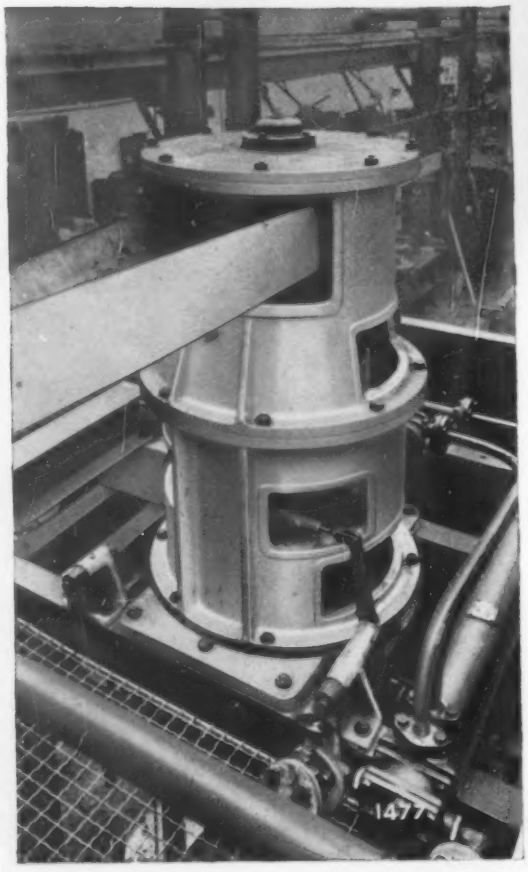

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Potassium between 150 and 300 p.p.m., which about covers the range met with in 0·6% molasses, increases the reading by between 3 and 9 units but in the presence of 0·15 to 0·30% sugar the increase is 13 to 16 even although the 0·15 concentration does not affect the Ca reading in the absence of K and Na. Na has comparatively little effect unless present in quantities much greater than is normal in molasses.

Since standards containing sugar do not keep, the following procedure is adopted. Set the photometer scale at 85 with a solution of 40 p.p.m. Ca. Determine the reading with plain water. Multiply this value by 1·2 to compensate for the absence of sugar and K. Let the water reading be 20, then the corrected value is 24 and the difference from 100, viz. 76, is the number of degrees corresponding to 40 p.p.m. Ca. Suppose the sample reading is 62, i.e. 38 when corrected for the blank, then it contains 20 p.p.m. Ca. If the water readings exceed 20, the burner probably needs attention as described above.

A similar procedure is adopted for thick juice except that the solution contains 3 g per 100 ml of juice and owing to the higher sugar concentration the standard setting is 70 and the water blank must be multiplied by 1·4.

Different amounts of lead subacetate solution (55° Brix) were added to 52 g raw juice and the solution made to 200 ml and filtered. Flame reading were as follows :—63, 57, 63, 63, 72 for 2, 3, 4, 6, 8 ml lead solution. Normally 4 ml is used for polarization. It was not considered practicable to devise a method which would allow for the lead acetate error.

Thin juice can be diluted to a concentration of about 2% sugar and tested like thick juice. Table 4 shows some comparisons between the flame and EDTA method both determined under routine conditions.

TABLE 4

ANALYSIS OF JUICES AND MOLASSES FOR Ca BY FLAME AND BY EDTA

MOLASSES		THIN JUICE	
Flame	EDTA	Flame	EDTA
0·36	0·35	0·0134	0·0147
0·78	0·87	0·0097	0·0099
0·60	0·61	0·0101	0·0099
0·36	0·34	0·0080	0·0082
2·80	2·58		
		THICK JUICE	
		0·096	0·092

ESTIMATION OF Ca IN WHITE SUGAR

The solution for estimation of Ca (as well as K and Na) in white sugar should be fairly concentrated but viscous solutions do not suit the flame photometer; therefore, 10% was considered a reasonable compromise[2].

A 10% solution of sugar free from K, Na, and Ca was prepared by passing it through a column of "Zeokarb 225" at a few drops per second. The solution gave no reaction for Na in the flame photometer and gave no colour with Solochrome Black indicator.

A standard containing 8 p.p.m. Ca was prepared by diluting 2 ml of 400 p.p.m. stock solution to 100 ml with the purified sugar solution. The instrument was set to 100° with the standard. A blank reading was taken with the purified sugar solution. For example, if the blank reading is 28 and the sample 39, then the standard less blank reading is 72 and the sample less blank 11. Since 72° corresponds to 8 p.p.m. the solution contains 1·2 p.p.m., and the sugar therefore 12 p.p.m. since a 10% solution is used. The 622 mμ wavelength was found suitable. The slit width must not exceed 0·8 mm or sodium will interfere so badly as to make it impossible to apply a correction. For this reasons standards containing less than 8 p.p.m. could not be used at the 100° setting.

The Ca in white sugar can also be determined using EDTA. The method used is as follows[15]: Titrate 5 ml of standard Ca solution (containing 400 p.p.m.) with EDTA using a few drops of "Solochrome Black" (1% solution in triethanolamine) and 10 ml of buffer (1 litre normal ammonia and 200 ml normal ammonium chloride) in a volume of about 50 ml. Add 100 g sugar in 400 ml water and 40 more of buffer. Add 1 ml indicator and titrate. Correct for the added Ca. Several attempts were made to determine Ca by EDTA in sugar ash but no end point could be obtained. The trouble was apparently due to heavy metal interference as the addition of a crystal of potassium cyanide remedied matters. In the original sugar the metal may have been sequestered by amino-acid.

Some comparison analyses by different methods are given in Table 5. The sugar was a rather high ash sample (0·03%). Some of the variations are no doubt due to accidental contamination by calcium in the air of the laboratory. The floor is concrete and the walls are whitewashed. Lorries with waste lime pass nearby. The situation is, therefore, not ideal for micro-analysis, yet the results agree fairly well.

TABLE 5

REPLICATE ANALYSIS FOR Ca IN WHITE SUGAR.

Sample Used	*Method*	Ca (p.p.m.)
Sugar	Flame	12
		18
		10
Sugar	EDTA	11
		14
		12
Ash	Flame	14
		19
Ash	EDTA	19
		12
	OVERALL AVERAGE	14

CONCLUSION

Flame photometry can be used to determine calcium in most sugar factory samples from beet to white sugar. It is interesting to note that HELENA ZAORSKA[16], has devised an automatic control of 2nd

[15] *I.C.I. Alfloc Branch Leaflet* 1950, (3981), 2.
[16] *Zucker*, 1958, **11**, 330, *I.S.J.*, 1959, **61**, 118.

saturation by a combination of flame photometer and pH meter. As long as the lime salts content (flame photometer reading) is decreasing no gassing control is in action. If it starts to rise pH control is automatically switched on so that gas is reduced for a falling pH and vice versa.

NOTE.—Subsequent to the submission of the above article for publication, BEND & HUTTON (*Analyst*, 1958, **83**, 684) have recommended the use of sulphuric acid to reduce and standardize calcium interference in flame photometry of sodium.

ACKNOWLEDGMENT.

The writer thanks the Directors of the Irish Sugar Co. Ltd., for permission to publish this paper.

MILL TORQUE AS A FUNCTION OF ROLL LOADING

PART III.—Comparison with Practical Results

By C. R. MURRY

11. THREE-ROLL MILLS

The author holds the view that the velocity feeding conditions of the experimental two-roll mill make its behaviour similar to the behaviour of the delivery nip of a three-roll mill with a large mill ratio. It is suggested that this is so for mill ratios of 2 and beyond.

HUGOT (*loc. cit*) suggests that the separating force between the top and delivery rolls is approximately equal to the total hydraulic load on the top roll of a conventional three-roll mill. This suggests that equation 15b should be applicable to three-roll mills.

No direct measurements of torque and roll load in a 3-roll mill have been made under properly controlled conditions to the author's knowledge. However, an indirect method of testing equation 15b against independent results exists. It is necessary at the same time to assume that the inequalities 17 hold for a 3-roll mill.

The Sugar Research Insitute (Mackay, Queensland) have an experimental three-roll mill on which maximum crushing rate tests have been carried out. In one of these, reported elsewhere[17], a delivery work opening of 0·296 in was used and tests carried out at approximately 15, 29 and 44 feet per minute surface speed. The preparation used corresponds, roughly, to the "fine" of table 7. The roll diameter is 18 in so that diameter effects are eliminated. We may apply the inequalities 17 and equation 15b as follows :

$$\frac{W_o}{D} = \frac{0{\cdot}296}{18} = 0{\cdot}0164$$

$$\sqrt{\frac{W_o}{D}} = 0{\cdot}128$$

$$N_{max} = 0{\cdot}75\sqrt{\frac{W_o}{D}} + 0{\cdot}03 \qquad \text{from (17)}$$

$$= 0{\cdot}126$$

Hence from 15b using $K = 0{\cdot}39$ we have :

$$0{\cdot}126 = 0{\cdot}39 C_{max} \times 0{\cdot}128$$

whence $C_{max} = 3{\cdot}43$

$$q_{max} = C_{max}\, d_o W_o S$$

$$= 3{\cdot}43 \times 71 \times \frac{0{\cdot}296}{12} S$$

$$= 6{\cdot}0\ S \text{ pounds per min}$$

$$= 0{\cdot}16\ S \text{ tons cane per hour per foot.}$$

The values obtained from this estimate and the experimental values are tabulated in table 8. Since maximum rate experiments are difficult to perform and the roll groovings are not identical the agreement is remarkably good.

Therefore, on the information available, equation 15b may be assumed to apply to three-roll mills.

Table 8.

CRUSHING RATES OF 3-ROLL MILL (tons/hour)

Speed f.p.m.	$q_{estimated}$	$q_{experimental}$
15	2·4	2·4
29	4·65	4·8
44	7·0	6·6

12. APPLICATION OF EQUATION 15b

Providing the limitations set out in Section 9 are kept in mind, equation 15b should be of fairly general application. For work opening-diameter ratios of greater than 0·024 the experimental mill is capable of obtaining a maximum N of 0·15 (figure 3). Similar conditions should arise in any mill although the actual value of N may be different. Assuming $K = 0{\cdot}36$ and $N = 0{\cdot}15$ we may write :

$$0{\cdot}42 = C_{max}\sqrt{\frac{W_o}{D}} \qquad \ldots\ldots\ldots\ldots\ldots\ldots (18)$$

providing $\frac{W_o}{D}$ is greater than 0·024. This equation represents the maximum conditions—minimum K and maximum N. Hence the maximum compression ratio for any work opening may be calculated. It is

[17] ANON : "Two Rollers *vs.* Three Rollers", *Tech. Report.* (Sugar Research Institute, Queensland), 1958, (50).

immediately obvious that as W_o is increased the maximum compression ratio is decreased.

For work opening-diameter ratios less than 0·024 the position is not so clear. If the inequalities in 17 hold we may write :

$$N_{max} = 0{\cdot}03 + 0{\cdot}75\sqrt{\frac{W_o}{D}} = 0{\cdot}36\,C_{max}^{\frac{1}{2}}\sqrt{\frac{W_o}{D}}$$

that is,

$$0{\cdot}083\sqrt{\frac{D}{W_o}} + 2{\cdot}08 = C_{max}^{\frac{1}{2}} \quad \ldots\ldots\ldots(19)$$

This indicates, again, that as W_o is increased C_{max} decreases.

This view is held by CRAWFORD[18], the conclusion being drawn from the results of the Sugar Research Institute three-roll experimental mill. It also corresponds, of course, to the experimental results of Appendix I.

13. THE EFFECT OF FEED PRESSURE

It has been mentioned previously that only two methods of feeding the experimental mill have been used. The above results depend, therefore, on sufficient feed pressure being available to feed the mill with no slip at entry. The author believes that this condition is usually obtained at the delivery nip of a 3-roll mill providing a reasonably large mill ratio is used.

The equations above have been obtained without any close investigation of the feeding pressures, but it may be said, in general, that larger feed pressures are required as work opening-diameter ratios increase and as compression ratios increase.

14. ESTIMATION OF OPERATING CONDITIONS OF A NO. 1 MILL

Consider a 36 in × 84 in mill with a delivery opening of 1 in.

$$\frac{W_o}{D} = \frac{1}{36} = 0{\cdot}0278,$$

$$\sqrt{\frac{W_o}{D}} = 0{\cdot}167$$

Assuming that N_{max} may be somewhat greater than that of the experimental mill (the author feels that this is so since in Queensland methods such as arcing of the rolls are usually used to increase the surface roughness) we may apply the first inequality in 17 to obtain a value of N.

$$N_{max} = 0{\cdot}75\,(0{\cdot}167) + 0{\cdot}03 = 0{\cdot}155$$

From 15b, $C_{max}^{\frac{1}{2}} \dfrac{0{\cdot}155}{0{\cdot}36} \times \dfrac{1}{0{\cdot}167} = 2{\cdot}58$

$$C_{max} = 3{\cdot}54$$

(The value 0·36 has been used for K in an attempt to compensate for the diameter effect. Of course, the inequalities 17 may also be changed for different diameters).

From this maximum compression ratio we may estimate the extraction and crushing rate. Assume that the ratio of bagasse volume to escribed volume is 1·35. This value has been deduced from BULLOCK[3,7] and from information from various Queensland mills. Then the effective compression ratio is reduced by this factor (1·35) and becomes :

$$C_e = 2{\cdot}6$$

It is then easy to calculate or to obtain from curves of theoretical extraction in BULLOCK's work that

$$E = 69{\cdot}5\%$$

assuming 15% fibre and 20° Brix. The "pol" extraction will be somewhat higher than this. This represents the maximum extraction attainable with the settings assumed. The maximum crushing rate may be estimated as follows :

$$\begin{aligned} q_{max} &= C_{max}\,d_o\,W_o\,S \\ &= 3{\cdot}54 \times 71 \times \frac{1}{12} \times S \\ &= 21{\cdot}0\,S \text{ pounds/min/foot} \\ &= 0{\cdot}562\,S \text{ t.c.h./foot.} \end{aligned}$$

At 30 f.p.m.

$$Q_{max} = 0{\cdot}562 \times 30 \times 7 = 118 \text{ t.c.h.}$$

where Q_{max} is the total crushing rate.

This appears to be a little low in the light of Queensland practice but it must be remembered that both equation 15b and the inequalities 17 may be changed by preparation-diameter interactions.

If the top roll loading is known we may estimate the power required. Assuming that a roll load of 60 tons per foot is sufficient to keep the roll floating at 1–in work opening

$$\frac{G_{tot}}{RD} = N = 0{\cdot}155$$

Hence $G_{tot} = NRD$ but $P = \dfrac{2\pi n\,G_{tot}}{33000}$ in horse power and $n = \dfrac{S}{\pi D}$

Hence $P = \dfrac{2S\,N\,R}{33000}$ horse power $\ldots\ldots\ldots\ldots(20)$

and for our case

$$P = 270 \text{ h.p.}$$

HUGOT suggests that the bearing losses are given by :

$$P = 0{\cdot}001\,R^1 n\,D$$

This gives 48 h.p. for our case.

The author considers that no further adjustment of the power is necessary except for the efficiency of the engine and gearing. (It is assumed that the carriers are independently driven). The experimental mill is equipped with scraper plates and hence these are roughly included in the above estimate. The trash plate friction is more complex.

For a 3-roll mill we should probably write—

$$N = \frac{2G}{RD}$$

[18] *Proc. 24th Conf. Queensland Soc. Sugar Cane Tech.*, 1957, 89–103; *I.S.J.*, 1958, **60**, 76.

where G is the top roll torque. Since most of the effort of moving the bagasse across the trash plate is likely to come from the top roll the power estimate above should include the trash plate friction. Probably no convincing argument can be put forward for this view, but since the trash plate absorbs power due only to the hydraulic load, and since this power must be part of the torque applied to the top roll the suggestion does not seem unreasonable.

Assuming, after JENKINS[9], that the mill engine and gearing are 76% efficient we have a final power estimate of

$$P_{tot} = (270 + 48) \times \frac{1}{0{\cdot}76} = 420 \text{ h.p.}$$

This estimate is probably rather high for a mill crushing 118 t.c.h., but it depends (among other things) on the assumption of the necessary roll loading. In some Queensland mills as little as 45 tons per foot of roll is used to obtain satisfactory extractions. This would reduce the power to 315 i.h.p., a more reasonable estimate. If the roll were not floating (as is the case in the example quoted of 45 tons/foot) then the effective load and, therefore, the power must be less than this. 315 h.p. is the *maximum* power likely to be absorbed at 45 tons/foot loading.

15. USING N FOR MILL DESIGN

Table 1 and BULLOCK's work (see section 2) suggest that a range of N given by 21 below is possible.

$$0{\cdot}06 < N < 0{\cdot}20 \quad \ldots\ldots\ldots\ldots\ldots\ldots (21)$$

Using these inequalities it is possible to use N in the design of mills without other assumptions or information.

Hydraulically loaded mills : The second part of the inequality applies. If the roll loading is fixed at some definite maximum then the maximum possible torque for crushing would be :

$$G_{tot} < 0{\cdot}2\, RD$$

in consistent units. To this must be added estimated friction requirements.

Fixed Mills : In this case the minimum value of N is required. This will depend on the type of feeding arrangement used with the mill. It is possible to think of a mill being pressure fed at such a high pressure that no torque is required to turn the rolls. N would then be zero. This would, of course, be a very extreme case. For a mill under "self-feeding" conditions—that is, without any heavy forced feeding—the author feels that the following inequality will apply :

$$R < \frac{G_{tot}}{0{\cdot}06\, D}$$

Hence, if the total torque to the mill is limited and deductions made for friction losses, the maximum R may be determined and used for the design of the mill frame.

The above inequalities for N do not take account of foreign objects in the feed to the mill. The hydraulically loaded mill forms its own protection to some extent, but the author feels that, particularly on fixed mills, some form of torque limiting device should be used.

16. SUMMARY & CONCLUSIONS

The torque-load number N is a fundamental quantity relating the roll load and roll torque in a sugar cane mill. This relation can be expressed :

Total torque = N (roll diameter) (Roll load).

N has been found to vary over a fairly wide range in the experimental mill and this variation appears to be governed by the relation :

$$N = K\, C^{\frac{1}{4}} \sqrt{\frac{W_o}{D}}$$

where the values of K have not been completely investigated, but for the experimental mill appear to range from 0·35 to 0·42 approximately, depending on the preparation. N appears to have maximum values governed by the work opening-diameter ratio and the condition of the rolls. This variation has still to be investigated for different diameter mills.

Consideration of the maximum values of N gives rise to estimation of the maximum compression ratio at any work opening-diameter ratio. This estimation has been shown to agree with results from the Sugar Research Institute mill. It is felt, therefore, that similar equations to those developed from the 2-roll mill will hold for 3-roll mills in general with the limitations pointed out in the paper.

The applications of these equations will give results allowing the performance of a number 1 mill to be predicted. The roll load necessary for a given extraction is the only factor in serious doubt. This may easily be found by the sugar mill engineer, and it is hoped that his findings will later be confirmed by laboratory experimental and theoretical results.

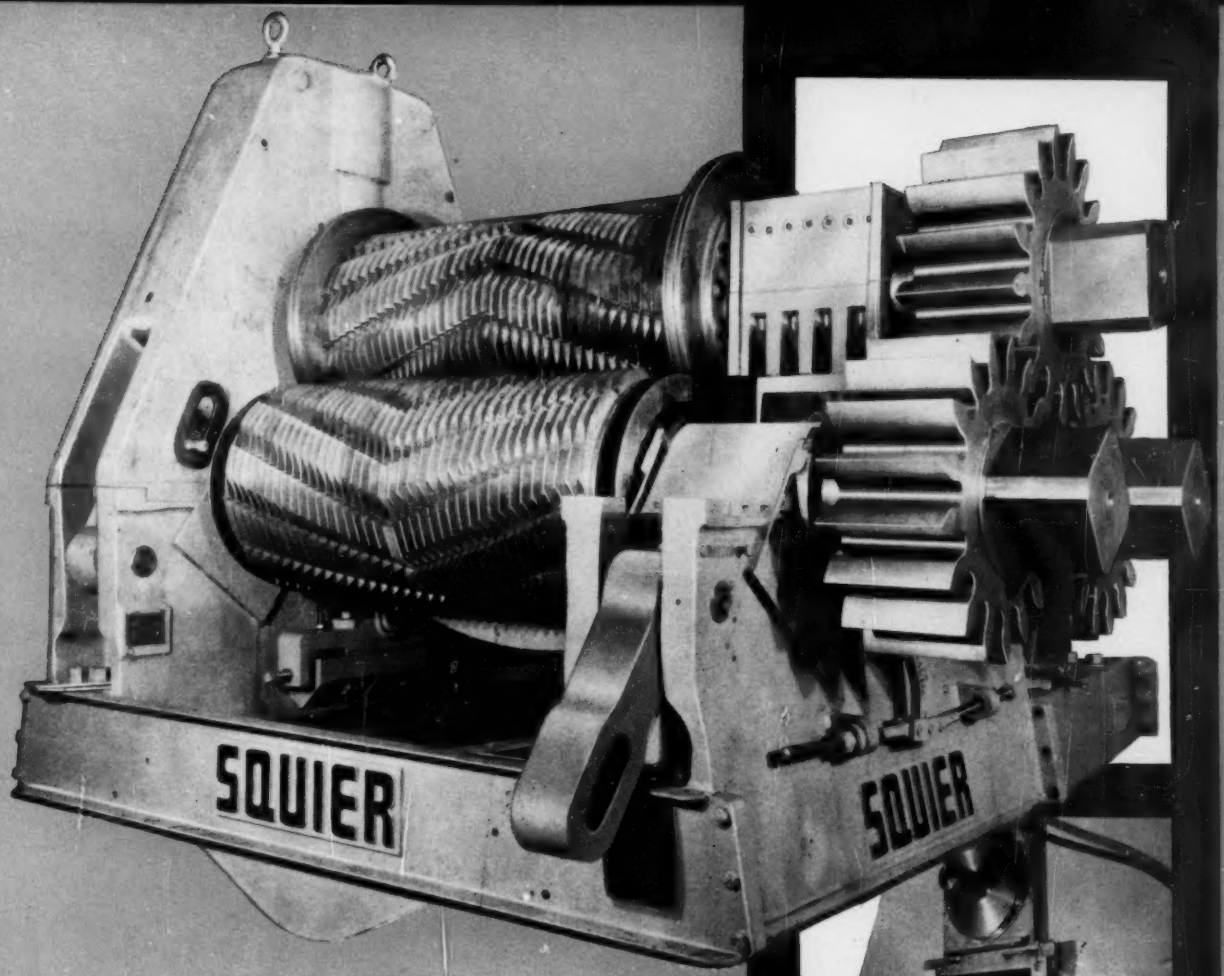
The general correspondence between these results and those of other workers and between these results and the general experience of the Queensland industry appear, to the author, to lend a deal of weight to the laboratory experimental and theoretical findings. The author would be very pleased to be informed of any data which either support or refute the above theories.

ACKNOWLEDGEMENTS

Thanks are due to Professor M. SHAW (Head of the Department of Mechanical Engineering) for laboratory space and equipment ; to Mr. G. H. JENKINS (Senior Lecturer in Sugar Technology) for access to his English translation of HUGOT's work, and to the Sugar Research Institute (Mackay, Queensland) for provision of the Fellowship under which the investigations are being carried out.

Sugar Production in the Philippines.[1]—Final production of sugar in the 1957/58 crop totalled 19,762,579 piculs (1,377,847 short tons) from an area of 183,700 hectares. This represents a yield of 107·62 piculs of sugar per hectare (3·05 short tons/acre). Production for 1958/59 is estimated at 19,856,923 piculs (1,384,425 short tons) from 197,260 hectares.

[1] *Sugar News* (Philippines), 1958, **34**, 607.



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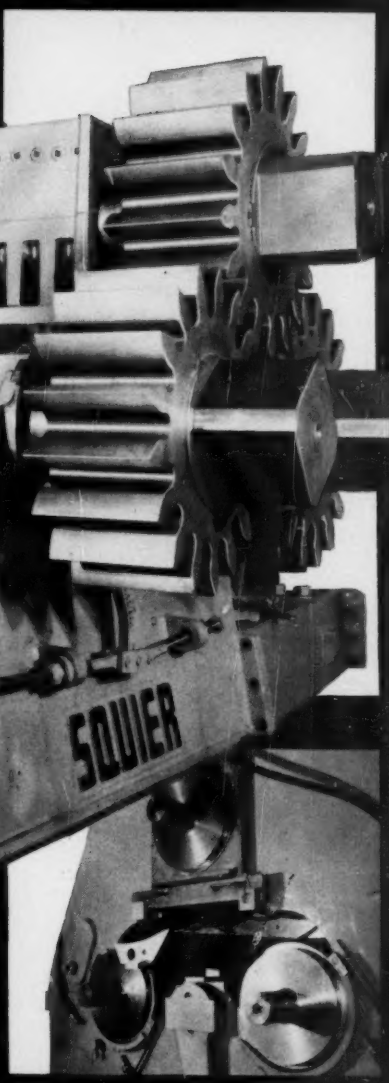

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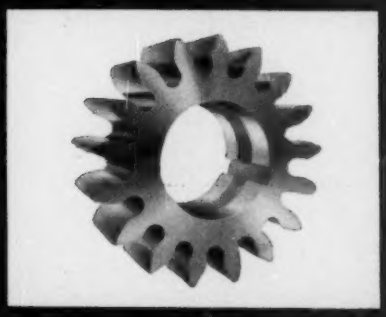

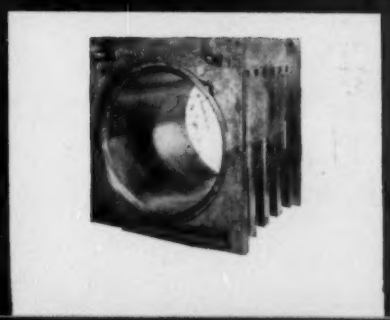

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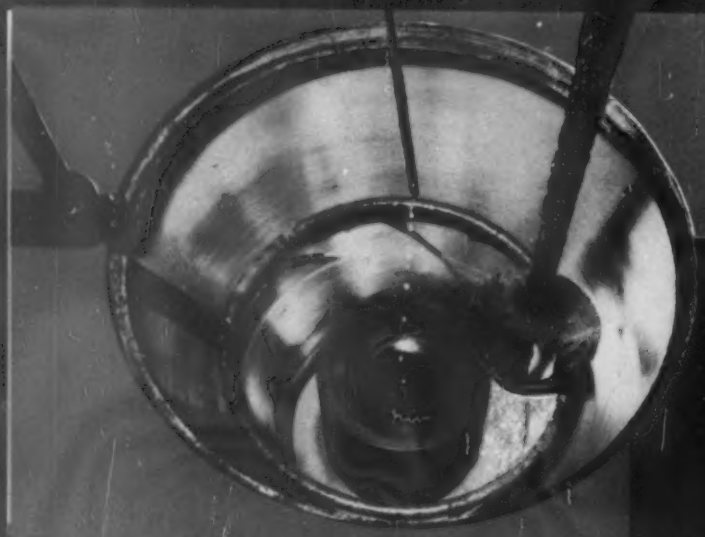

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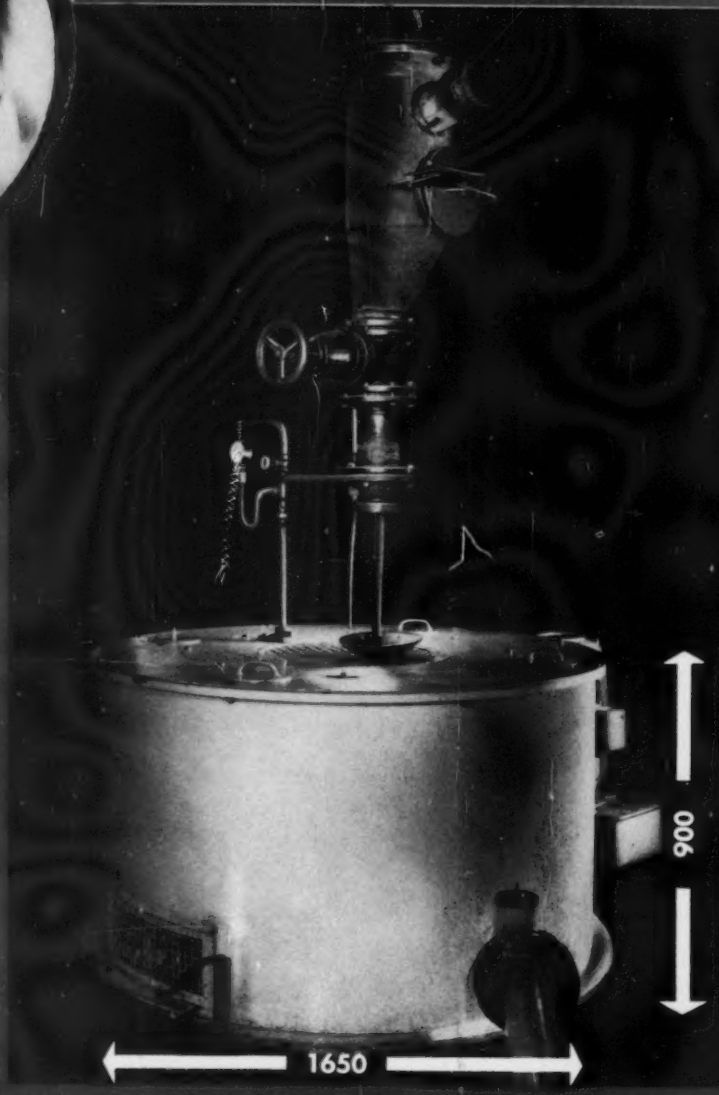

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THE FACTORS AFFECTING STABILITY AND FLOCCULATION IN CANE JUICE

By M. C. BENNETT

(Department of Sugar Chemistry and Technology, Imperial College of Tropical Agriculture, Trinidad, W.I.)

PART II.

Electrophoretic Data

From the stability effects described above it is clear that the greatest interest attaches to :

(a) the mechanism of the spontaneous flocculation between 50 and 60°C.

(b) the state of the system after 5 minutes boiling, for this represents a condition under which the commercial defecation would be carried out.

For this reason, the following three systems are chosen for an electrophoretic examination of each juice :

(i) the raw juice

(ii) the juice heated to 65°C for 2 minutes

(iii) the juice boiled for 5 minutes.

The juices used were from samples of B4098 (juice (b) above) and B37161 (juice (d) above) canes, both of which had experienced more than 10 weeks of natural drought. The zeta potential-pH curves obtained with these juices were compared with those obtained during previous studies[4, 5] on juice from canes which were grown under normal climatic conditions and which apparently would have behaved normally in the factory. In figure 2 are shown the curves obtained with such a juice, B37172 ; unfortunately the curve for the system heated to 65°C was not determined.

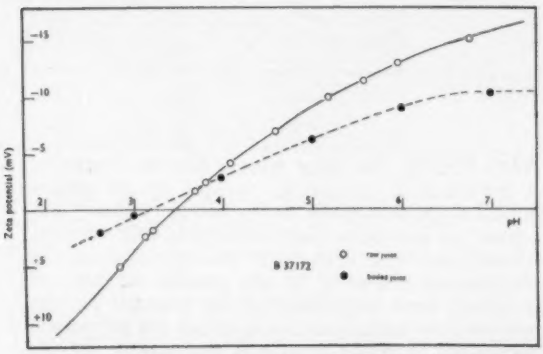

Fig. 2. ζ-pH curves for a normal B37172 juice (raw juice and boiled juice).

In figure 3 are shown the three zeta potential-pH curves for B37161 cane juice. The raw juice curve is seen to be very similar to that in figure 2 and in the vicinity of the isoelectric point (i.e.p.) at pH 3·4 it is not changed on heating to 65°C. Away from the i.e.p., the heating causes a depression of the zeta potential which indicates a reduction in surface charge density. This type of behaviour has been found[14] when a starch solution was added to an oil/water emulsion stabilised with bovine serum albumin, and supports the view that at natural juice pH values (ca. pH 5) starchy surface is produced on heating to 65°C. On boiling, the i.e.p. falls to pH 2·6 while the curve above pH 5 remains unchanged from that produced at 65°C. This is the first occasion on which we have recorded an i.e.p. below pH 3 and it is evident that the surface has become very much more acidic.

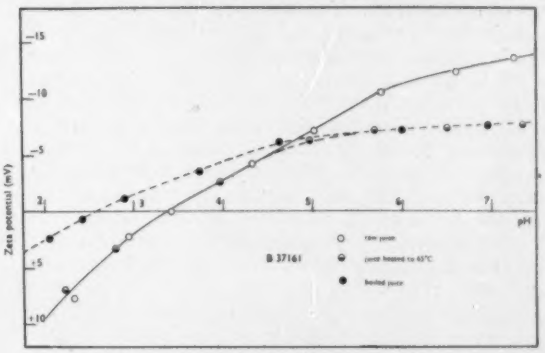

Fig. 3. ζ-pH curves for an abnormal B37161 juice (raw juice, juice heated to 65°C and boiled juice).

It can be seen that at the natural pH of this juice (pH 5·1) the heating and boiling has produced a change of no more than 1 mV in zeta potential while the stability has changed (see figure 1 (d)) from 56% to 8%. The curves shown in figure 3 demonstrate quite clearly that the particle surface has changed during the heating process.

In figure 4 are shown the three curves obtained using B4098 cane juice. The pattern is essentially the same as that found with B37161 with the most important difference that in this raw juice the i.e.p. lies at pH 2·1. This extraordinarily low value demonstrates the presence, at the particle surface, of a strongly acidic material which was not present in the juices grown under normal climatic conditions. This acid characteristic is found in the raw juice in B4098 but only appears on boiling in B37161.

The two raw juices used here have widely different zeta potential-pH curves and they therefore provide an opportunity to justify the original hypothesis that the changes studied here are related to adsorption effects at the particle surface rather than intrinsic differences in the particles themselves. Each raw

[14] Unpublished work.

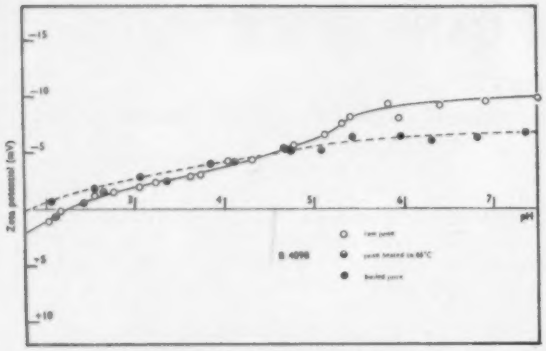

Fig. 4. ζ-pH curves for an abnormal B4098 juice (raw juice, juice heated to 65°C and boiled juice).

juice was adjusted to pH 8 with NaOH, and the flocs, which consisted of particles and calcium phosphate, were centrifuged off. The two sediments were allowed to drain for 30 minutes and then redispersed in each other's clarified juice after readjustment of the juices to pH 5. By this means we were able to exchange all the particles in one juice with all the particles in the other, and then again determine the zeta potential-pH curves. These are shown in figure 5 where it is seen that the character of the raw juice is quite definitely associated with the clear continuous phase and not with the particles. It must follow that the electrophoretic behaviour (and indeed stability) of the particle system is determined by material adsorbed from the continuous phase.

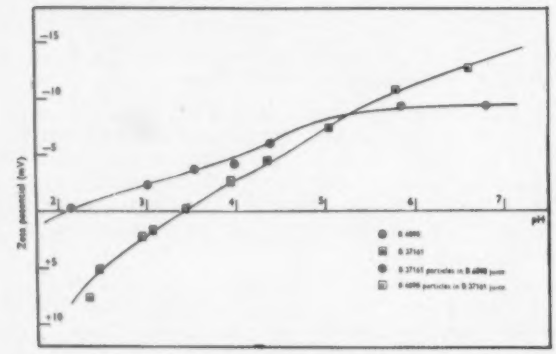

Fig. 5. ζ-pH curves for B4098, B37161 raw juices and for the juices made by exchanging all particles. The ζ-pH characteristics lie in the continuous phases.

We can obtain further information concerning the nature of the particle surface from an examination of the plots of zeta potential against concentration of various added electrolytes. For electrolytes with a common anion (e.g. nitrate) the relative adsorbabilities of the different cations can be obtained from the relative concentrations of these cations necessary to reduce the zeta potential to zero ; if these concentrations are arranged in the form of a spectrum it is found that both their sequence and their values are different for different colloid types[16]. Thus carboxyl colloids, such as arabinate, may be distinguished from phosphatides and from sulphate colloids such as agar. The spectra of many natural substances are now known and these serve as standards with which the spectrum of any unknown material can be compared. The method has been applied in studies of the nature of bacterial surfaces[16,17].

In our studies on cane juice particles, zeta potential—concentration curves were obtained using solutions containing 5 ml juice in the required electrolyte concentration ; pH was maintained at 5·0 ± 0·1. The maximum electrolyte concentration in which mobilities could be satisfactorily determined (see Experimental above) was N/10 so that with weakly adsorbed cations like Na^+ or Li^+ it was not possible to measure the reversal of charge point. In these cases the reversal of charge concentration was determined by extrapolation of the zeta potential—concentration curve. The reversal of charge spectra for B 37172 (cf. fig. 2) and B4098 (cf. fig. 1 (b) and fig. 4) are shown in figure 6.

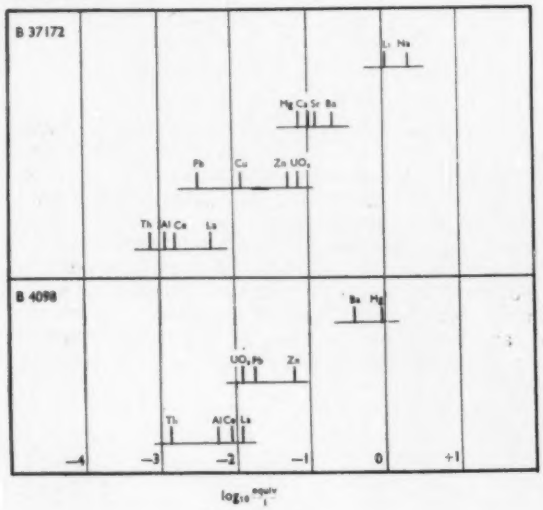

Fig. 6

With B37172, the juice which behaves normally, the spectrum is similar to, though by no means identical with, that given by an oleate surface[15] and we have an indication that carboxyl (COO^-) groups are more important than might be expected from the proteinaceous character of the particle surface. It has already been suggested that the material present at the particle surface in this juice has the properties of a mucoid in which protein is conjugated with an acidic mucopolysaccharide[4].

With the B4098 spectrum, three important changes are noted :

[15] BUNGENBURG DE JONG in "Colloid Science", *ed.* KRUYT, Vol. 2, ch.IX (Elsevier, Amsterdam), 1949.
[16] DAVIES, HAYDON AND RIDEAL : *Proc. Royal Soc.*, 1956, **145B**, 375.
[17] DOUGLAS AND PARKER : *Trans. Faraday Soc.*, 1957, **53**, 1494.

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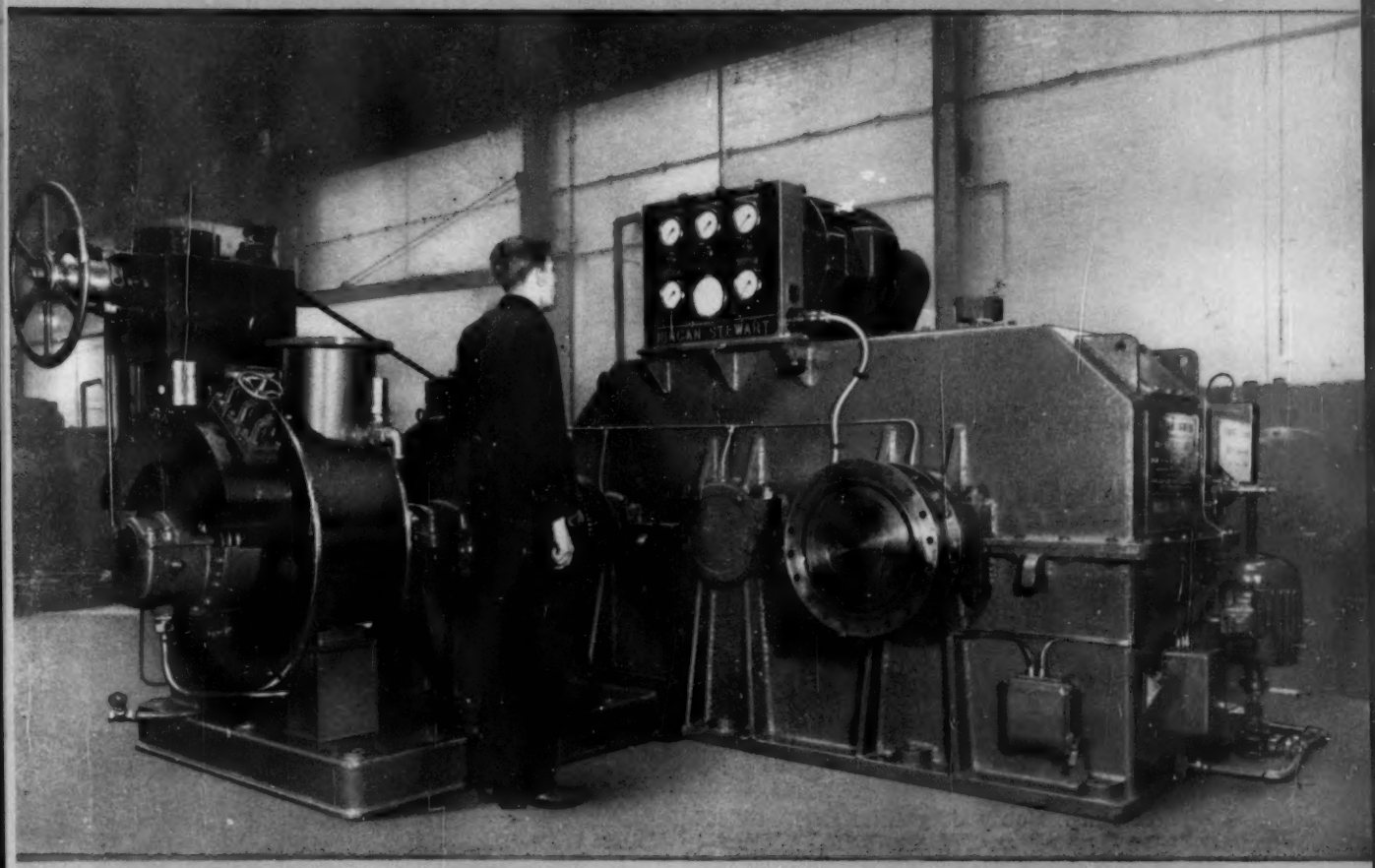

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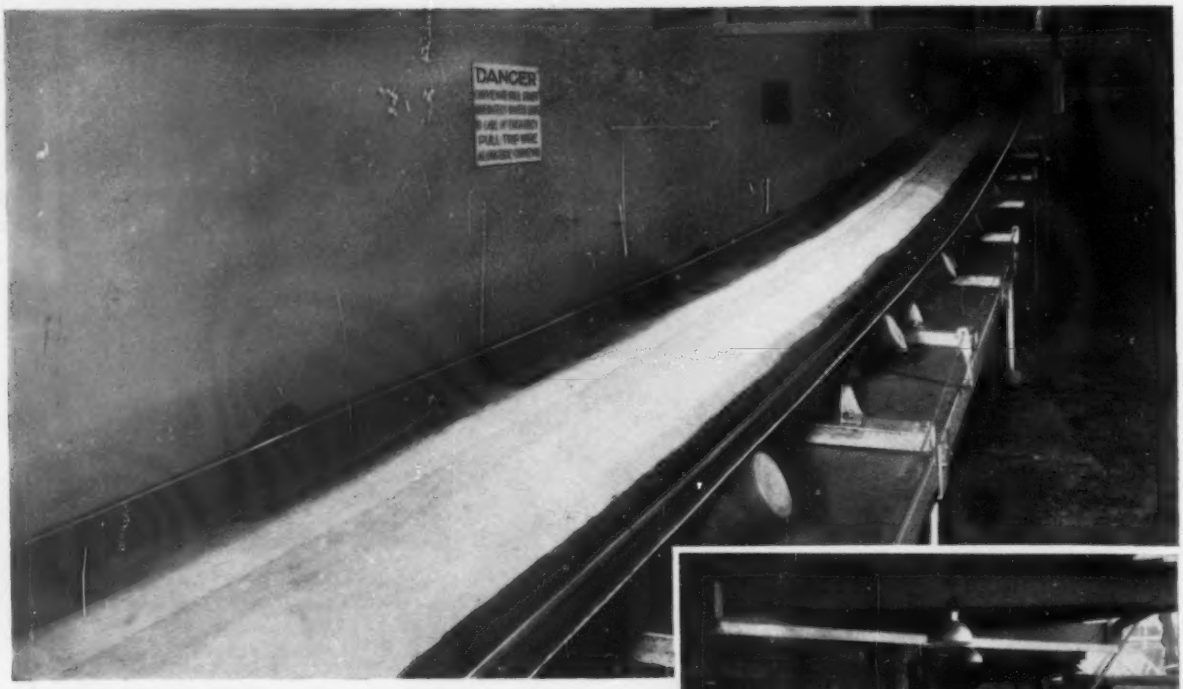

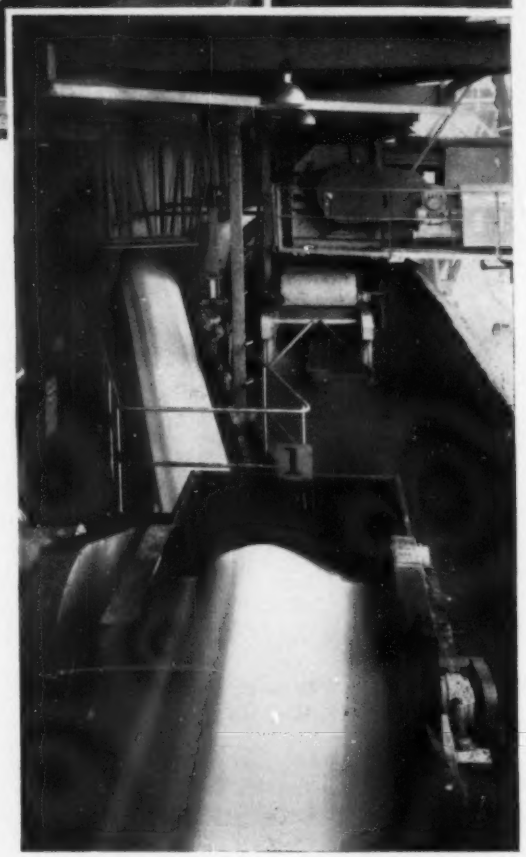

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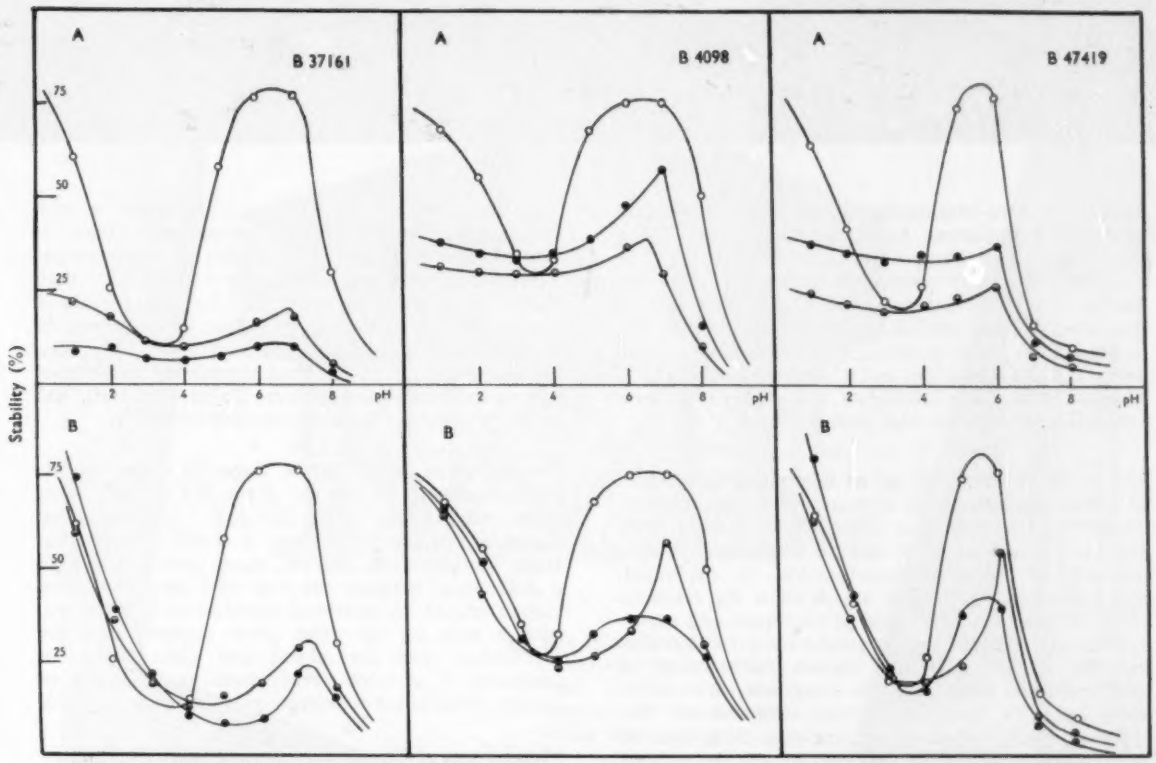

Figs. 7, 8 and 9. Stability-pH curves for B37161, B4098 and B47419 respectively. ○ raw juice, ◒ juice heated to 65°C for 2 min, ● juice boiled for 5 min. (A) Series : heat treatments carried out at raw juice pH, and stability-pH change determined on cooled samples. (B) Series : heat treatments carried out at each indicated pH, stabilities being determined on cooled samples.

(i) there is a general displacement to higher concentrations,

(ii) the position of UO_2^{2+} in relation to Pb^{2+} and Zn^{2+} is quite different,

(iii) the order of Mg^{2+} and Ba^{2+} is reversed.

Reference to the spectra of BUNGENBURG DE JONG[15] shows that sodium pectinate is the only substance giving a spectrum which resembles that of B4098 above. The sequence of reversal of charge concentrations is in very close agreement though the actual values are, with most cations, significantly different. Nevertheless, it is believed that this spectrum provides evidence that an acidic polysaccharide, which carries an appreciable number of free (unmethylated) carboxyl groups, exerts a dominating influence in this B4098 juice.

Stability Data

(i) *The effect of pH.*—It is of interest to study the dependency of stability upon pH in the various systems described above for, by this means, it is possible to determine the response of the juice system to calcium phosphate precipitation. The three systems chosen were again : raw juice, juice heated to 65°C and juice boiled for 5 minutes.

In figures 7, 8 and 9 are shown the stability-pH curves for three juices : B37161 (cf. fig. 3), B4098 (cf. fig. 4), and B47419. Each figure contains two series of three stability curves described as the A and B series respectively. The A series were determined using systems in which the raw juices had been heated to 65° and boiled 5 min at their natural pH, cooled, and the change in stability with pH then determined. Thus the curves in fig. 7A and 8A may be compared with the zeta potential-pH curves shown in figs. 3 and 4 respectively. The B series of curves were determined on systems in which the raw juices were first adjusted to the pH values indicated and the heating, boiling and subsequent cooling carried out at these pH values. The raw juice curve is shown in both A and B series.

(To be continued.)

Roumania Sugar Situation.[1]—Despite an increase in the area allotted to the growing of sugar beet, the outturn, which amounted to about 1·6 million tons, was insufficient to utilize fully the total factory capacity this season, according to *die Wirtschaft des Ostblocks*. Two new factories are planned to be in operation for the 1960/61 season, by which time it is anticipated that the production of roots will have risen to about 2·8 million tons.

[1] C. Czarnikow Ltd., *Sugar Review*, 1959, (392), 30.

Test of the Two-Massecuite System with Full Seeding of the First Molasses. M. R. IRIMIA AGUILA. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 153–156.—The two-massecuite system has been tried at Ingenio San Carlos in Ecuador, and the technique used is described. Grain uniformity has increased and this is illustrated. It is essential to have control instruments for pan operation, and it is emphasized that it is essential that the centrifugals are efficient in their separation of crystals and mother liquor.

* * *

Use of the "Cuitometer" as an Instrument for Control of (Pan) Operation. P. HONIG and F. DE MIGUEL. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 169–197.—The basis for use of conductivity as a measure of sugar supersaturation is explained, and experiments described which show the relationships between viscosity, specific resistance and supersaturation. These make conductivity a suitable variable to measure and record for control of pan operation where vacuum conditions are sufficiently stable to maintain constant temperature. The types of electrode developed are described, and an account given of the instruments in use throughout the cane and beet industries. A method is described for arranging that the milliammeter reads directly in supersaturation units, and the graphs produced in a number of boilings are interpreted.

* * *

A Good Technique for Manufacture of Bulk Sugar Using the Two-Massecuite System. A. L. WEBRE. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 199–210.—Standards for sugar satisfactory for bulk handling are : uniform grain of adequate size ; a minimum of impurities ; low moisture content ; and a sugar temperature about that of atmospheric. The first of these is discussed with reference to both 2 and 3-massecuite systems, and a table prepared of boiling house quantities for various apparent purities. The use of the two-massecuite system is considered to give the lowest impurities level while the other two requirements are only briefly mentioned.

* * *

The Benefit of High-Speed Centrifugals in Reduction of Non-Sugars in Circulation and the Exhaustion of Final Molasses. P. HONIG and F. DE MIGUEL. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 211–217,—The differences between high purity and final massecuites which affect their purging are reviewed, and the behaviour of massecuites in centrifugals treated theoretically, with the quotation of two formulae defining (i) the rate of drainage of molasses and (ii) the proportion eliminated. These are both shown to depend on the centrifugal force which increases with centrifugal speed. Another important factor is viscosity of molasses and a table of experimental values illustrates the rapid rise in viscosity with reduction in water content. The formula (ii) above can be used to examine the effect of variations in massecuite Brix, spinning time and temperature, etc., on elimination. It can be used, therefore, to determine the optimal conditions of centrifugal operation, and details are given of the technique employed.

* * *

Production of Direct White Sugar in Cuba. B. R. ARGÜELLES and R. ARTZE. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 229–235.—Arguments are advanced for the production of direct consumption sugar for the world market, since there is too high a differential between the cost of Cuban raws and Cuban refined. A system of sulphitation is described, with a note on the extra plant required and the production costs for refined and white sugar are compared in a table. Precautions to be taken in storage of the direct consumption sugar are mentioned.

* * *

Melassegens of Cane Juice. Indispensible Preliminary Step Towards Scientific Calculation of Retention and Efficiency. L. R. BLISS. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 249–269.—The attempts to provide equations for relating the non-sucrose in juice, syrup, etc., with the sucrose obtainable are reviewed. If the specific melassegenity f is defined as the factor connecting the sucrose retained in a particular sugar solution by the non-sucrose present, it can be represented by the equation :

$$f = \frac{a.f_a + b.f_b + c.f_c + d.f_d + \ldots.}{a + b + c + d + \ldots\ldots,}$$

where a, b, c, and d are the melassegenic impurities and f_a, f_b, f_c, f_d, etc. are their individual melassegenic factors. These last must be determined by carrying out experiments with an analysed solution in contact with finely powdered sucrose. By varying the concentrations of individual constituents and analysis of the equilibrium solutions, the individual factors may be determined. The nature of these constituents and their effects is discussed, with references to the literature, together with the errors which can arise if apparent purity is taken as a criterion of molasses exhaustion.

* * *

The Corliss Valves and their Kinematics. U. VILLAR LORENZO. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 271–283.—The Corliss engine was invented in 1850 and the advantages of the Corliss valves, as modified since that date, are reviewed, together with the types and disposition of valve and their kinematics.

★ The illustration shows a Horseley-Piggott Pressed Steel Tank which was supplied to the Dearne Valley Water Board.

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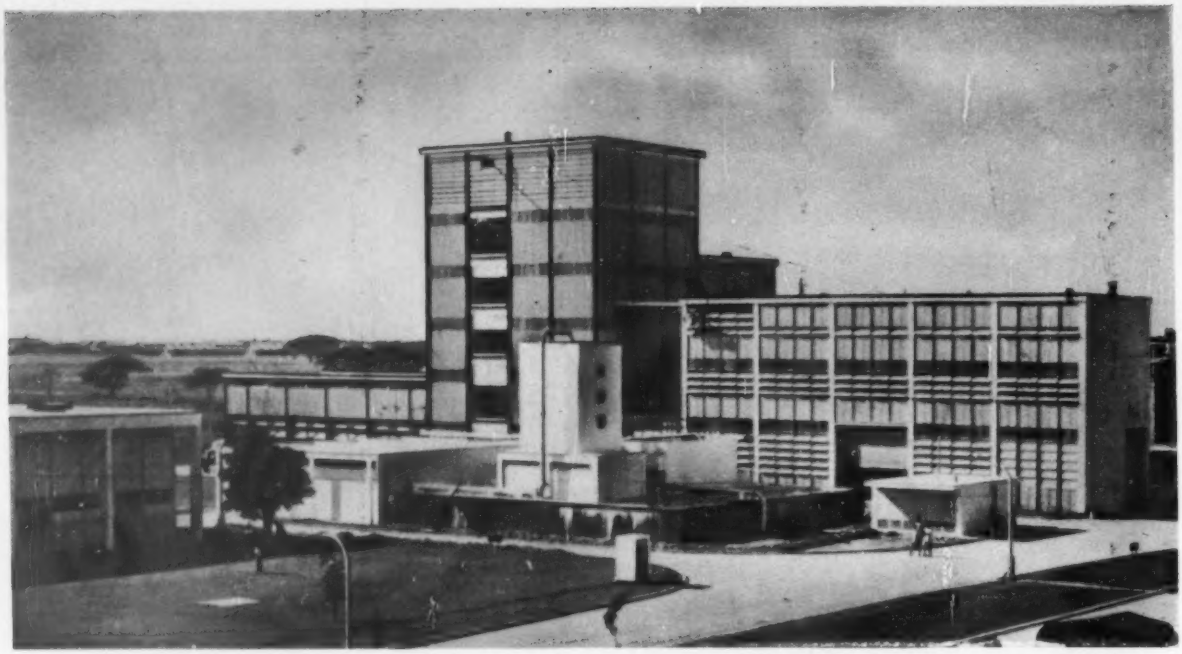

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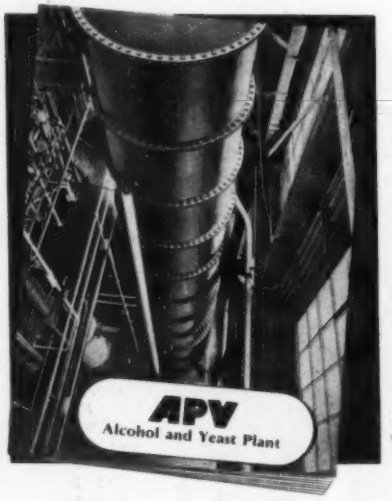

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Statistical Bases for the Cane Mill. S. PÉREZ ALONSO. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 285–290.—Milling data, for 10,020 sets of circumstances, are used as a basis for examining milling performance. With such a number it is believed that a true picture is achieved. It is concluded from the tabulated results that the density of cane fibre varies with its proportion by weight ; that imbibition is better expressed as per cent weight of cane than of fibre, since it is more logical to consider it in terms of fibre volume and there is a greater constancy between the volumes of cane and fibre, while the density of fibre varies more than the density of cane ; and that the equation :

$$\text{Compensated extraction} = 100 - \frac{130 + I}{I + 10}$$ is a truer representation of the relation of compensated extraction and imbibition.

* * *

The Sinusoidal Diagram as a Radiograph of the Function of a Corliss Engine. U. VILLAR LORENZO. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 291–307.—A sinusoidal diagram illustrates the relation of the positions of the Corliss valves with those of the piston, crankshaft and centre of the eccentric, and so is considered to be the best graphical method of studying the design of the Corliss engine. The advantages of the method are discussed in detail with the aid of such diagrams.

* * *

Improvements in Milling Plant. J. C. GONZÁLEZ MAÍZ. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 309–316.—Aspects discussed are : feed conveyors for the crushers at Central Santa María and Central Triunfo ; metallization of journals ; cane knives between mills ; a stainless steel inclined bedplate for crusher and first mill, etc.

* * *

Causes of Entrainment in Steam. I. L. PUIG. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 317–322.—The causes of entrainment in boilers are considered to be (i) foaming ; (ii) priming ; (iii) formation of droplets which do not form a blanket but fill the vapour space of the dome ; (iv) mechanical entrainment due to the absence or bad state of the steam purifier ; and (v) inadequate feed regulation. These are discussed with notes on their occurrence, prevention and the difficulties which they cause.

* * *

Breakage of the Journals. E. N. HERRERA. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 323–335.—Visual examination of a large number of broken journals shows that they fall into two general types with well defined characteristics and localizations. A study of the forces and torque acting upon them indicates that the cause of failure is fatigue, resistance to which is lowered by ordinary corrosion and fretting corrosion ; change of sections, and surface imperfections. A study of these conditions and the mechanism of the breakage gives rise to a series of preventive measures against cracking due to fatigue and against the growth of cracks once started.

Liberal Application of Caustic Soda and High Alkalinity in Boiler Waters. A. FAJARDO. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 337–344.—Treatment of boiler water and the effect of caustic soda are discussed. Caustic embrittlement is localized generally at the unions of riveted plates or at the junctions of tubes and tube-plates. Its rapid and active progress at the expense of small concentrations of NaOH is attributed in the literature to the conversion of iron and water to ferric oxide and hydrogen, NaOH entering the initial reaction but being liberated again so that it is not consumed ; this theory is borne out by the presence of Fe_3O_4 layers between the characteristic crystals of inter-crystalline cracking. The NaOH is thus said to act as a catalyst under the pressure and temperature conditions of the boiler.

* * *

Vibrating Screens for Cane Juices. W. STILZ and J. ARMADA. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 345–349.—The functions carried out by the vibrating juice screen are described—transporting separated material, agitation of the blanket to aid drainage, dislodging of adhering particles, uniform distribution over the whole surface, and adequate retention before discharge. The vibrating type are compared with other screens, and the mechanical advantages discussed.

* * *

The Place of the Milling Plant in better Control Methods and Systems. J. DÍAZ COMPAIN. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 351–355.—With increasing instrumentation in the factory and better methods of control, it is believed essential to have more certain knowledge of the performance of the mills. Such information must show if the feeding has been uniform, if the speeds have been correct, if imbition has been effective, if the hydraulic system has worked satisfactorily ; if drops in steam pressure have been due to wet bagasse feed to the furnaces ; what has been the lost time and if the settings need alteration. Fitting of instruments, e.g. a lift recorder to the top roller, ammeters for the motors, hydraulic pressure recorders, etc., will provide this information.

* * *

Modernization of the Factories to Increase Production. E. C. NIESTRATH. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 357–361.—The steps which can be taken to increase the capacity of cane milling tandems are reviewed.

* * *

Adjustment of Mills. Method of Volumes in Transit. E. F. GONZÁLEZ ALONSO. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 363–372.—The method of calculating the "volumes in transit" of cane (or bagasse), fibre and juice for each of the compressions in a mill tandem is explained and examples worked out. From the values obtained the settings of the mill rollers are calculated. It is acknowledged that other factors, mill slip, re-absorption, etc., are not taken into consideration, but it is believed that the calculations give a simple way of providing information on the mill's action.

Economic Study of a Sixth Mill in a Tandem with a Set of Knives and a Crusher. A. ARVESÚ GASSET. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 373–378.—It is concluded, from an economic study of the costs of installing and maintaining a sixth mill and the return for the extra sugar extracted, that such an installation would be uneconomic except where crushing the company's estate cane or cane contracted for by area.

* * *

Non-Ferrous Metal Tubes used in the Sugar Industry. A. R. RUÍZ. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 379–386.—The conditions of operation of tubes in the sugar industry, types of failures, manufacture, types of non-ferrous metals used, and selection of materials are discussed.

* * *

Design of Pans. C. M. ALONSO Y SOLER. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 387–391.—The total resistance to heat transfer includes resistance of the steam condensate film, the metal thickness, and the massecuite resistance. The latter is so large that the much greater heat conductivity of copper compared with iron in tube construction raises the total heat transfer coefficient only from 28·6 B.Th.U./sq. ft./°F to 28·8. The higher cost of copper therefore means that it is uneconomic except where scale forming must be cleaned with acid which would attack iron ; it is much more effective to increase the total heat transfer coefficient by installing mechanical circulation equipment which will improve the transfer coefficient of the massecuite.

* * *

Return Water Balance of a Factory. P. DÍAZ QUINTANA. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 393–410.—Recommendations are made, as deduced from calculations, for reducing the raw water intake in boiler feed. They include: not working with too high exhaust steam back-pressure ; not cleaning the equipment when the syrup in the pans is of too low Brix ; not diluting first and second molasses too much ; utilizing flash from the last three vessels of the quadruple by installing a siphon barometric return arrangement ; use of a closed system of feeding return water to the boilers to keep it at the same temperature as when leaving the calandrias ; and avoidance of sugar entrainment in the pans.

* * *

Experiences in Commissioning a Bent Tube Boiler, Spreader Fired, Burning Bagasse or Coal. H. FOTHERINGHAM. *Proc. 31st Congr. S. African Sugar Tech. Assoc.*, 1957, 42–49.—A bent tube water-tube boiler, designed to burn coal and/or bagasse and to produce 100,000 lb steam/hr with a working pressure of 200 p.s.i., was installed at Felixton factory in 1955. The first two years' experiences are discussed in detail. A number of difficulties were encountered and details of these and their remedies are given.

An Induced Draught Type Cooling Tower. F. E. TREWREN. *Proc. 31st Congr. S. African Sugar Tech. Assoc.*, 1957, 50–52.—An i.d. counterflow cooling tower erected by the Fluor Corporation at Rossburgh refinery is described and illustrated. The tower comprises two cells and water is pumped to the top at 2500 g.p.m. and 55 ft head by 3 centrifugal pumps and is sprayed into the distribution chamber. As it falls, the water droplets are further broken up by layers of grids, which also serve to retard the water to permit longer air-water contact. Fans located at the top induce a draught of cold air up through the cascading water, which transmits heat to it by evaporation. Evaporation loss on very hot days is estimated by the makers at 1% of circulated water per 10° cooling, while on cool days it may be 0·75%. Maximum spray loss is 0·2%. The tower has a capacity of 450,000 g.p.h. cooled from 120° to 85°F at 76°F wet bulb temperature.

* * *

Some Notes on the Hyperbolic Cooling Tower at Maidstone. J. R. GUNN. *Proc. 31st Congr. S. African Sugar Tech. Assoc.*, 1957, 53–55.—The construction and performance of the Maidstone tower are discussed. Rating of the tower is 300,000 g.p.h. cooled from 120°F to 95°F at 63°F wet bulb temperature. In a discussion the costs and efficiency of this tower are compared with those of the previously described i.d. cooling tower at Rossburgh[1]. The efficiency is shown to be about 50% in comparison with 70% at Rossburgh, and the construction costs are higher, although maintenance costs of the Rossburgh tower are considered higher.

* * *

Prevention of Entrainment and the Construction of Save-Alls. W. H. WALSH *et al. Proc. 31st Congr. S. African Sugar Tech. Assoc.*, 1957, 50–60.—The causes of entrainment in evaporators and vacuum filters and pans are discussed and the various types of save-alls are considered. The high evaporation rate demanded of an evaporator of insufficient capacity is considered a major cause of entrainment, the replacement of sulphitation by defecation giving rise to the demand for greater evaporation rates. Entrainment is virtually eliminated from an evaporator, designed so that juice is introduced tangentially and the calandria is placed outside the vessel. The possibility of determining the actual sucrose losses due to entrainment is discussed, but it is pointed out that this is difficult owing to the intermittent nature of entrainment. A "Metex" saveall was not successful on a pan, as it became choked with sugar. Losses through the condensers of the vacuum filters, caused largely by air leaks, have been cut by replacing the metal tubing in the filters with plastic tubing.

* * *

Report on the Hein-Lehmann Continuous Centrifugal. P. N. BOYES. *Proc. 31st Congr. S. African Sugar Tech. Assoc.*, 1957, 61–67.—Tests with the Hein-Lehmann cone-type continuous centrifugal[2] are

[1] *See previous abstract.*
[2] *See I.S.J.*, 1957, **59**, 186.

described. The machine is powered by a 35 h.p. motor and its cone can be rotated at 1500, 2000 and 2600 r.p.m. by a choice of pulleys. Passage across the screen occupies only 3–4 sec. With *A*-massecuites considerable crushing of sugar was experienced, running at 2000 r.p.m. and using a 0·25 mm screen. Wet steam had to be used for washing, as even the slightest amount of water produced very wet sugar. Similar results were obtained with *B*-sugar, which was insufficiently purged and too wet. The crushing action at 2600 r.p.m. was not so great however. As the end of the season was approaching, the *C*-massecuites were cured hot. Results were encouraging, the Hein-Lehmann machine sometimes giving better results than batch machines, which, however, were curing cold massecuites at 45°C. Moisture in *C*-sugars is not so important where they are used as footings, although the pol is lowered. The machine might be suitable for affination in a refinery.

* * *

Some Observations on the Filtrability of Natal Raw Sugars. J. B. ALEXANDER. *Proc. 31st Congr. S. African Sugar Tech. Assoc.*, 1957, 68–75.—Filtration tests were made at the S.M.R.I. using a bomb-type apparatus designed at the Johns-Manville Research Laboratory[1]. The sugars tested were Natal laboratory-affined *A* and *B* defecation sugars and export sugar. It was found that phosphates do not affect filtration, while, although starch did not have a noticeable effect on filtration in the tests,[2] it is felt that it may have greater effect when the filtering medium is precipitated in its presence, i.e. in carbonatation. Silica and wax greatly inhibited filtration. As the silica content in some cases was less than the solubility of silica under the test conditions (85–90 p.p.m.), it is thought that the effect of this impurity on filtration may be due to the correlation between silica and wax, although it is not known whether the two are associated with each other within the sugar crystal or not[3]. The analysis procedures are described and full details are given of the results. A regression equation is given for the relation between C_1, the resistance to filtration, and % wax, where :

$$C_1 = 0{\cdot}74 + 0{\cdot}93\left(\frac{\text{wax}^3}{1{,}000{,}000}\right)$$

and a graph is drawn of C_1 *vs.* wax content. In a discussion on the paper, the need to prevent silica going into solution is stressed ; but to do so is considered difficult, even where some has been precipitated during defecation.

* * *

Bone Char in Sugar Refining. Its Use and Testing. D. HASTILOW. *Proc. 31st Congr. S. African Sugar Tech. Assoc.*, 1957, 76–85.—The use of bone char in refining and its manufacture are reviewed. The Scotch and the Nichols-Herreshof char regenerating kilns are described and compared and the decolorizing and ash removal cycle is described in detail. Laboratory testing of the char is covered, with an account of the Hulsar Bone Char Testing Apparatus, and the merits and demerits of "Synthad" and Pittsburg Activated Granular Carbon Type CAL are discussed.

Some Notes on the Extraction of Sucrose from Cane by Diffusion. C. VAN DER POL. *Proc. 31st Congr. S. African Sugar Tech. Assoc.*, 1957, 86–91.—Pilot-plant trials on cane diffusion were made at Illovo, in which a single-scroll horizontal screw conveyor was used. The capacity of the plant was 600 lb cane/hr and the diffusion temperature was 95°C. The cane was shredded on a type of fixed-blade hammer mill, an average of 10% of the cane feed comprising cane chips at least ½in long. Results from 15 experiments were much worse than would be obtained from milling, an average of 0·87% of pol in juice being inverted (ranging from 0·04% to 2·21%, and mean extraction was 86·2% pol (80·9%–92·7%). It was found that 72% of the pol remaining in the diffused cane was present in the coarse pieces. Examination of the diffuser residue showed that after passing through a hand mill, the expressed juices contained 7·9% of the pol in cane, 4·0% was present in final bagasse, and 1·0% in drainings. Hence return of the juice + drainings would increase extraction considerably—from 87·1% to 96%. Moisture of the final bagasse was 63·5%. At Entumeni the cane is passed through a crusher and a mill before diffusion. Moisture is reduced to 50–54% and extraction is 90–92%, despite carryover of cane on the carrier between the 1st and 2nd mills to the last mill with the diffusion juice.

* * *

A Further Report on the "True" Seeding of Vacuum Pans. E. BEESLEY. *Proc. 31st Congr. S. African Sugar Tech. Assoc.*, 1957, 108–115.—Tests made at Tongaat, Umfolozi and Illovo on the "true" seeding technique previously described are[4] discussed. It was found that the use of steam during actual graining resulted in the loss of some slurry, so that a modification of the technique was tested on *A* molasses at Illovo ; in this the steam supply is shut off when the conductivity drops to the level of the metastable zone upper limit. The conductivity continues to drop 4–5 mA until equilibrium, when the vacuum is raised sufficiently to give brisk boiling with a moderate decrease in conductivity e.g. about 1·5 mA/min. The slurry is taken into the pan at fairly high conductivity in the metastable zone and boiling down continues until the conductivity is 1–2 mAs above that at which the grain is brought together, when the pressure is raised by shutting off the condenser water. Boiling is restarted when the grain has grown sufficiently to avoid dissolution (in the case of *A* molasses grain, about 30 min after the end of the first boiling). This technique gave very satisfactory results and full details are tabulated.

* * *

Exhaustion of Green Syrup Without Reboiling. A. MIRCEV. *Listy Cukr.*, 1958, **74**, 129–131.—The process previously described[5], whereby 1st green syrup is matured in a cooling crystallizer, was tested

[1] *See I.S.J.*, 1942, **45**, 48.
[2] *Cf. I.S.J.*, 1958, **60**, 333.
[3] *See also I.S.J.*, 1957, **59**, 150–151.
[4] *I.S.J.*, 1955, **57**, 167–168.
[5] *I.S.J.*, 1954, **56**, 319.

at Trebisov factory. After 5 hours' boiling, the massecuite, boiled on 87–88 purity green syrup and remelt of low purity (93–94), was discharged to two cooler crystallizers. It was then crystallized over a period of 22–24 hr, hot green syrup being added at intervals. Spinning yielded a black syrup suitable for processing in the recovery house. Steam consumption is cut by this process. The crystallization period may be reduced to 19–20 hr according to quality of the green syrup and method of boiling.

* * *

Cane Crushing Season in India and Loss of Sugar. J. M. SAHA. *Indian Sugar*, 1958, **8**, 47–49.—While the crushing season in India sometimes starts in November and ends in April, or even July, in some regions the amount of cane to be crushed limits the season to 65–85 days. The cane crushed in November (when it is unripe) or after April (when it is over-ripe) gives low sugar recovery and high molasses yield, so that it is recommended that the season be from the beginning of December to the end of April (150 days). The sugar and monetary losses incurred by a factory in Northern India are given as an example.

* * *

Exhaustion of Clarifier Muds. J. M. SALINAS. *Bol. Ofic. A.T.A.C.*, 1958, **17**, 321–323.—Factors which affect the insoluble solids content of filter and clarifier muds are mentioned, including phosphate content of the juice, and clarifier and filter capacity. Details are given of 1958-crop analyses.

* * *

Technical Limits of Heat Consumption in the Coke-Fired Shaft Lime Kiln. H. EIGEN. *Zucker*, 1958, **11**, 306–309.—In calculations of the heat requirements of a coke-fired lime-kiln the heat of reaction at 20°C (422 cal/g $CaCO_3$) is considered the useful heat. This temperature is particularly important, as the heat required to raise the temperature of $CaCO_3$ from 20 to 900°C (at which the heat of reaction is 395·8 cal/g $CaCO_3$) is greater than the heat liberated by cooling the CO_2 and CaO from 900°C to 20°C. The heat consumption per g of lime is considerably affected by the difference between gas and feed temperature at the boundary separating the preheating and the combustion zones. A temperature difference of 30°C will give a working thermal efficiency of 90% and a heat consumption of 774 cal/g lime with 93% free CaO. Small limestone and a high preheating zone will give the required low temperature difference.

* * *

San Cristóbal Tops World's Grinding Record. M. ST. ALBANS. *Sugar y Azúcar*, 1958, **53**, (7), 30–33.—A description is given of the equipment, facilities and personnel of the 7150-ton Mexican factory, Ingenio San Cristóbal.

* * *

Centrifuging of Mixed Juice as an aid to the Production of a Better Raw Sugar. J. B. ALEXANDER. *S. African Sugar J.*, 1958, **42**, 579–583.—Laboratory trials showed sugar of better filtrability could be obtained by removing starch from mixed juice with a centrifuge. In factory-scale trials at Umzimkulu an Alfa-Laval QX 210–30 separator was used and removed 80% of the starch present in mixed juice. Sand erosion of the recycling tubes and bowl caused some trouble and it is proposed, in further trials, to use a hydrocyclone prior to the centrifuge, the bowl of the latter to be rubber-lined. Blocking of the nozzles, etc., with sand and bagacillo was reduced by using larger nozzles, but this greatly increased recycling, so a finer vibrating screen is to be used. Maximum sludge concentration was found to be 9% solids. The sludge could be disposed of by spreading on the bagasse blanket leaving the second mill, although this might cause a build-up of starch over the train.

* * *

Bulk Handling at Imperial Sugars. ANON. *Sugar J.* (La.), 1958, **21**, (2), 12.—See *I.S.J.*, 1958, **60**, 292–295.

* * *

Chemical Control of Boiler Blowdown. H. E. A. BORGER. *Indian Sugar*, 1958, **8**, 137–139.—Savings in heat (23·84 million B.Th.U./day) and the cost of the coal saved thereby are calculated for a boiler evaporating 1,400,000 lb of steam per day at 200 p.s.i.g. and using 5% blowdown, when a flash evaporator and heat exchanger are installed for transferring heat from the blowdown to the replacement feed water. The technique for chloride analysis in boiler water is decribed ; this is the basis for judging when the blowdown should be carried out.

* * *

Mathematical Control of Sugar Losses by Inversion in Evaporation. G. LAMOGLIA Y FRAU. *Bol. Ofic. A.T.A.C.*, 1958, **17**, 393–396.—An equation is developed for inversion of sucrose at constant temperature, viz. $\log \frac{a}{a-x} = kt$, where a = initial sucrose content, x = reducing sugars, t = time and k is a constant. The equation was found to give figures in reasonable agreement with analytical data obtained during evaporation, so that it can be used to show up abnormal losses.

* * *

Increase in Capacity of a Tandem. U. VILLAR LORENZO. *Bol. Ofic. A.T.A.C.*, 1958, **17**, 401–406.—Between 1954 and 1958, the milling capacity of Central Zaza has been increased by 21·62% as a result of minor changes in operation and equipment. These include : ceasing the pumping of juice previously added to the cane blanket in front of the second mill ; adding a feeder before the first mill ; adjustment and correction of steam distribution to the engine driving the crusher ; increasing the angle of entry of the cane feed to the knives so as to avoid slip ; adjustment of the first carrier to permit better feeding of the second ; reduction of slip in the 2nd and 3rd mills due to momentary acceleration of the engines ; increasing the speed of the turbine driving the cane knives from 500 to 600 r.p.m. by adding an additional nozzle ; changing the grooving of the crusher rolls and last mill rolls ; and controlling the speed of the crusher and mill engines in accordance with variations in the blanket thickness.

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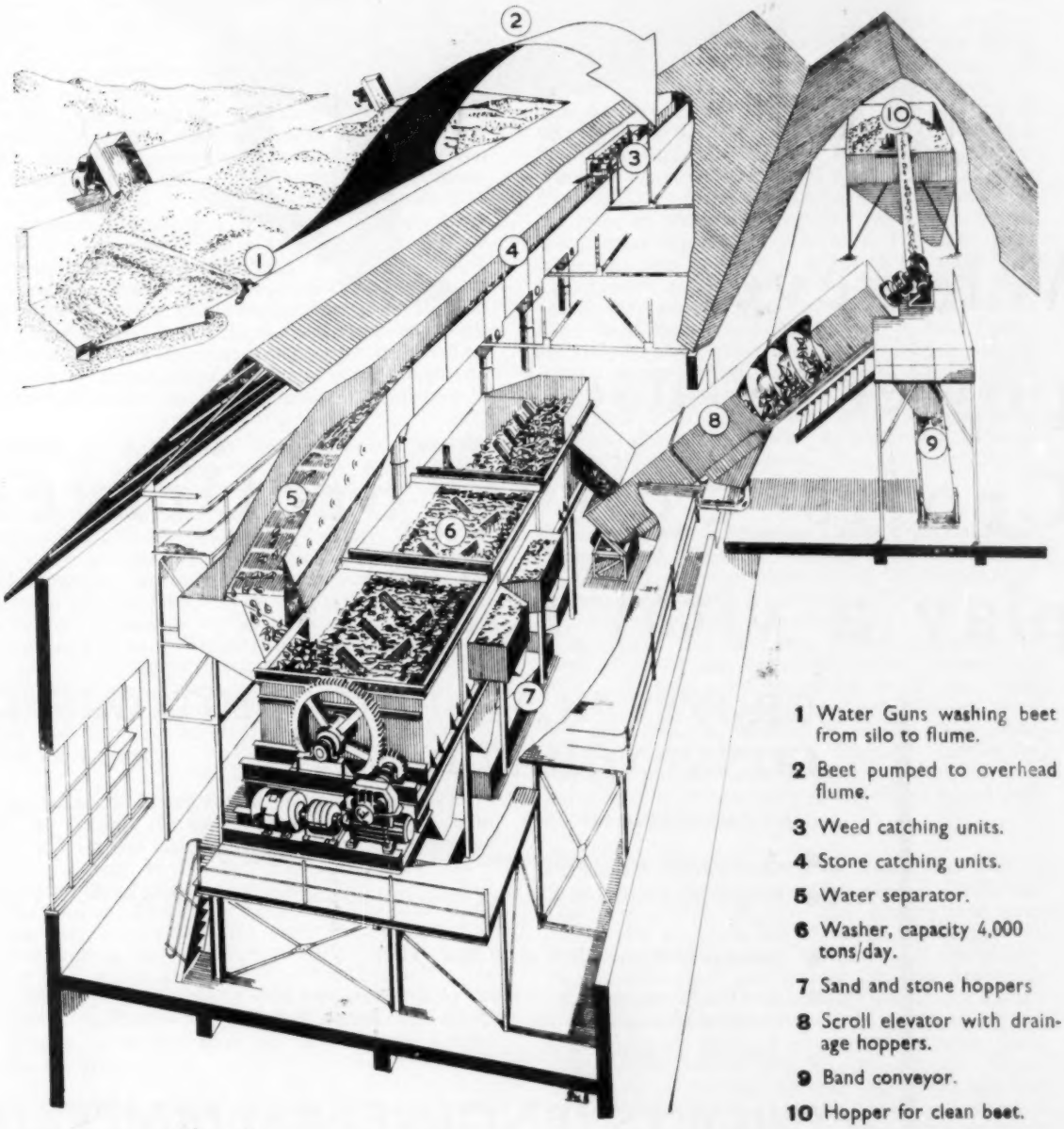

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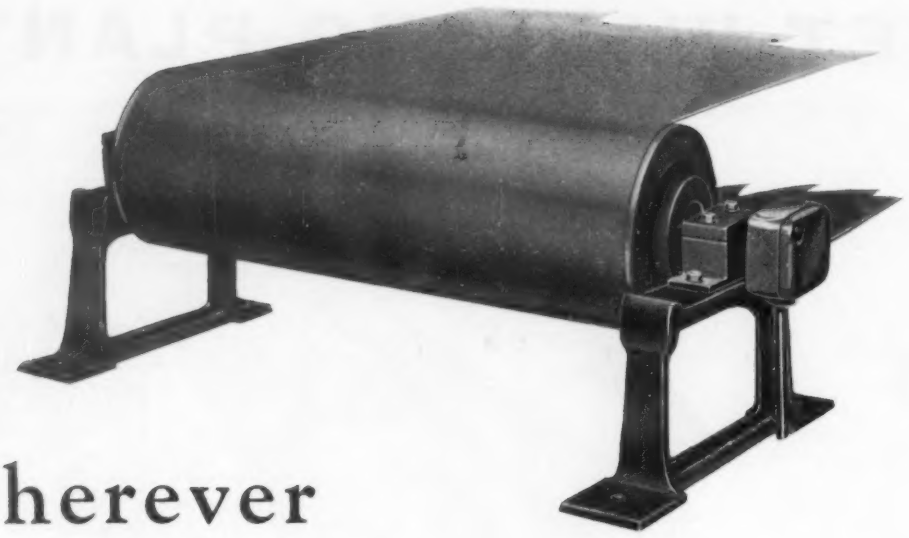

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BEET FACTORY NOTES

Phenomenon of Thermodiffusion in Sugar Solutions. G. I. KRASOVSKAYA. *Trudy Moskov. Tekhnol. Inst. Pishchevoi Prom.*, 1956, (6), 152–157 ; through *S.I.A.*, 1958, **20,** Abstr. 388.—When diffusion occurs in the presence of a temperature gradient, ordinary diffusion is complicated by thermodiffusion in which solute molecules migrate from hotter to colder regions. On heating the cossettes this effect causes sugar to migrate from the cossette surface inwards in a direction opposite to that of diffusion by the concentration gradient, thus retarding extraction. On the basis of A. V. LYKOV's theory it is shown that the osmotic pressure of a solution is a measure of its "transfer potential", and a relationship is derived between the relative coefficient of thermodiffusion (∂) and osmotic pressure. Morse's data on the osmotic pressure of sugar solutions are used to calculate ∂ for different temperatures and concentrations. It is shown that ∂ increases with concentration almost linearly to a maximum, which occurs, however, at lower concentrations with increasing temperature.

* * *

Locking of the Diffuser Bottom Door Hydraulic Seals. D. M. LEIBOVICH. *Sakhar. Prom.*, 1958, (5), 45–46.—A hydraulic locking device for diffuser bottom doors comprises a three-way valve, which, when closed, admits water to a cylinder, the piston of which is connected to the extended bottom door. The resulting movement of the piston causes the bottom door to pivot and close, whereupon water is admitted to another cylinder, the piston of which operates a lever to which is attached a pawl. This hooks on to the other end of the bottom door, keeping it firmly closed. Opening of the valve releases the pawl and permits the door to pivot open. The device has worked satisfactorily for one campagin at Belovodsk factory.

* * *

Operation of F–1 Filters at the Oktyabr' Sugar Factory. F. A. GLYBIN. *Sakhar. Prom.*, 1958, (5), 49–50.—In 1957 1st and 2nd carbonatation juice filter-presses were replaced by two multi-stage clarifiers and 3 vacuum filters for 1st carbonatation, and 4 F–1 Mar'yanchik filters[1] for 2nd carbonatation juice (one held in reserve). The filter area of each F–1 filter is 28 sq. m.; cloth consumption is 0·74 sq.m./100 tons of beet for the F–1 and 0·42 sq.m. for the vacuum filters (compared with 5·5 sq.m./100 tons of beet for the filter presses). Advantages and disadvantages of the F–1 filter are discussed and a flow-sheet is given.

* * *

Determination of Sugar Losses in Defecation Muds. S. ZAGRODZKI and H. ZAORSKA. *Zeitsch. Zuckerind.*, 1958, **83,** 269–272.—The sugar content of the mud sample is determined polarimetrically ; the CaO content is determined in the following manner : 25 ml *N* HCl is added to 10 ml of water-mud slurry to decompose the carbonates, and the CO_2 is boiled off. The solution is neutralised with NaOH and titrated against 10 ml of *N*/28 EDTA (corresponding to 10 mg CaO), to which has been added 20 drops of a buffer solution. When the mud is very thin and 10 ml is insufficient for titration of the EDTA, another 10 drops of buffer solution with indicator are added and the EDTA again titrated. This process is repeated and the mean of the two values used as the basis for determination of the sugar losses. An equation is developed for the calculation of sugar : CaO weight ratio (g sugar/g CaO) and a table of calculations given for various amounts of mud slurry (ml) per 10 ml ETDA. Multiplication of the value read off the table by the amount of lime added % on beet will give the sugar losses % on beet. For those cases where the lime addition is unknown the sugar and CaO content of a sample of 1st carbonatation juice are determined as above and the losses calculated from these figures and the sucrose % beet figure. Reproducibility is within the range + 2·1% to —4·2% for 10 determinations on the same samples. The determination takes only 20 min. The complexometric determination of the CaO content can be replaced by alkalinity determination with methyl orange, titrating with *N* HCl at boiling point. This takes only 2 min and gives an accuracy of 1–2%.

* * *

Experiences with Schumacher Candle Filters in Sugar Factories. E. ROSSLER. *Zeitsch. Zuckerind.*, 1958, **83,** 278–282.—The development of the Schumacher ceramic candle filter[2] is reviewed and experience with the filter in factories in Germany and other countries is discussed. The filter has proved satisfactory in filtration of 1st and 2nd carbonatation juices, thick juice and sugar solutions of up to 65° Bx. Acid cleaning of the ceramic material is carried out every 5–8 days and the material is usable for at least 4–5 campaigns. Results at Franken, Ochsenfurt and Rain-am-Lech factories show that filtration of a sugar solution will generally give a filtrate which does not show the Tyndal effect.

* * *

Preliminary Communication on Tests with NH_4Cl as an Active Substance. A. MIRCEV and Z. FRIMLOVÁ. *Listy Cukr.*, 1958, **74,** 131–132.—Factory tests were carried out at Sered and Dobrovic on addition of NH_4Cl or Na_2SO_3 to the dilution water drawn into the vacuum pan just before striking low-grade massecuites[3]. The two salts were added at 6 kg per 47 metric tons of massecuite and the purity of the final molasses obtained was compared with those from parallel strikes without salts addition. Where the purity of the final molasses was >60, addition of the salts gave a molasses 1% lower in purity than that from control boilings. Where the molasses purity was <60, the differences were smaller, the sodium sulphite effecting a 0·6% reduction and the ammonium chloride a 0·3% drop.

[1] *See I.S.J.*, 1955, **57,** 81.
[2] *See I.S.J.*, 1955, **57,** 320.
[3] *Cf. I.S.J.*, 1955, **57,** 443.

Lessons from the 1957 Campaign and the Aims of Sugar Technology. G. TIBO. *Sucr. Belge*, 1958, **77,** 401–426.—The 1957 campaign in Western Europe, in particular Belgium and Britain, is reviewed.

* * *

Increasing Sugar Factory Production by Reducing Diffusion Juice Draught. L. E. FLEISHMAN. *Sakhar. Prom.*, 1958, (6), 23–26.—For those factories with a large number of beets to process, increasing the daily beet throughput is made possible by reducing diffusion juice draught. A drop in juice volume from 115–116% to 105% gave an increase in daily throughput of 10% during tests at one factory, with a corresponding cut in fuel consumption of 0·53% on beet. Diffusion losses in the 13 working cells of the battery increased by 0·29% to 0·76% on beet. A drop in molasses purity of 0·20% was effected. A juice purity increase of 1·9% was also obtained.

* * *

The Use of Natural Cold for Beet Preservation in the Altai. P. N. SHAMYAKIN. *Sakhar. Prom.*, 1958, (6), 27–28.—It has been found possible to increase campaign length by 70–100 days by completely freezing the beets. This is achieved by forced ventilation through underground air ducts, and covering the piles with mats, straw, snow, and sawdust. Transferring of the beets by crane to neighbouring piles is also effective.

* * *

Hydrochemical Method and Apparatus for Saturation Control. A. D. MALIKOV. *Sakhar. Prom.*, 1958, (6), 28–31.—A suggested method of continuous saturation control is described with the aid of a diagram. Defecation juice flows at constant rate from a control tank to a storage tank through a constant suction jet pump. The compression chamber of the pump is suppled with CO_2 delivered by way of an orifice-type flowmeter and a regulator. The latter consists of a bell jar in a water bath, and regulates gas pressure to within $+$ 0·001 atm, corresponding to a variation in water level of $\pm$ 1 cm. With an increase or decrease in gas consumption, the bell jar descends or rises, opening or closing a gas feed valve. The pressure of the gas supplied to the flowmeter is constant and the pressure difference across the diaphragm, caused partly by the action of the pump and partly by absorption of CO_2 in the juice, is measured. As the suction of the pump is constant, the CO_2 absorption can be calculated and the juice alkalinity determined.

* * *

Centrifugal Screens. I. A. ROSTRIPENKO. *Sakhar. Prom.*, 1958, (6), 34.—When brass screens with punched oblong holes were replaced by screens with punched round holes in semi-automatic self-discharging centrifugals, it was found that : the cycle lasted 4 instead of 3 min ; the wash-water requirement increased from 18 to 26–30 litres ; discharging was unsatisfactory ; screens had to be washed more frequently, and the molasses yield increased. The effective area was 20% as opposed to 40% with the other screens.

* * *

Automatic Control of Second Carbonatation by Means of a pH Meter and Flame Photometer. H. ZAORSKA. *Zucker*, 1958, **11,** 330–333.—An apparatus for automatic control of second carbonatation is described and illustrated. Juice from second carbonatation is passed through a flame photometer and a pH meter, readings being taken at one-minute intervals. The reading from the latter and from a standard buffer pH meter is fed to a differential pH meter which controls the CO_2-valve to the carbonatation tank. The flame photometer is connected to a CaO recorder which is inter-connected with a pH controller such that the latter adjusts the buffer pH above to the optimum for minimum lime salts corresponding to the CaO content of the juice. This it does by addition of either acid or alkali to the buffer solution in which the glass electrodes of the buffer pH meter are immersed.

* * *

The MW-Factor as Criterion for the Processing Qualities of Beet. E. SOMMER. *Zeitsch. Zuckerind.*, 1958, **83,** 323–325.—The relationship between beet sucrose and ash content and between molasses and white sugar yields have been established in East Germany on the basis of analytical and statistical data from the 1956/57 and 1957/58 campaigns. An equation has been developed in terms of pol and ash for the MW factor (molasses yield % white sugar yield) which is considered to be a useful guide as to the quality of the beet when studying the influence of the vegetative and ripening periods, soil, climate, disease, etc. It also acts as an indication of the comparative processing quality of diploid and triploid beets and of the various parts of the root. Graphs show the changes of the MW factor during the vegetative period.

* * *

Shibaura Seito, The Latest Beet Sugar Factory in Japan. A. P. MÜLLER. *Zeitsch. Zuckerind.*, 1958, **83,** 326–331.—The Japanese beet sugar industry is surveyed generally and the sugar factory at Kitami, built in 1956–57 and owned by Shibaura Seito Refining Co. Ltd., is described and illustrated.

* * *

Filtration of 1st and 2nd Carbonatation Juices on a Self-Cleaning Filter. R. BERLINE. *Génie Chim.*, 1958, **80,** 1–6.—A description is given of the type-DNRS filter of S.A. des Filtres Philippe. This is a leaf pressure filter, each leaf being divided into eight sectors feeding into separate exit pipes together with juice from corresponding sectors in other leaves. Water jets are mounted inside the casing for washing the cakes ; sludge loss is reduced to 0·1–0·2% on average, and solids content is 40%. The cloths last throughout a campaign, and only one man is needed to operate a battery of four filters. Alternatively, the filter can be used as a thickener for concentration of muds without water washing, when the cake is removed by back-washing with filtered juice.

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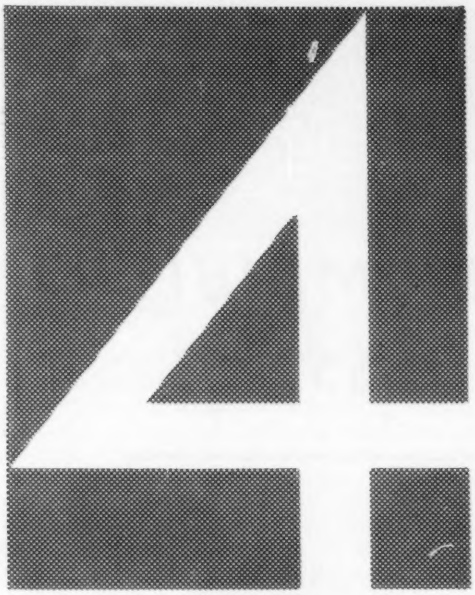

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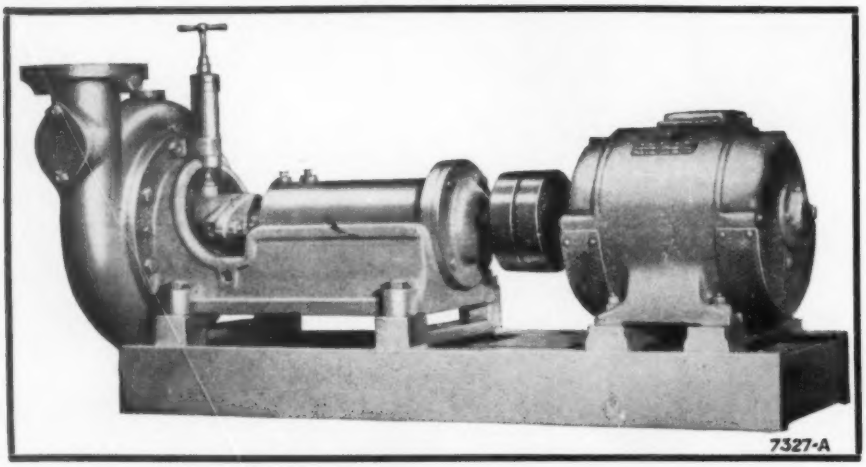

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New Books and Bulletins

Principles of Sugar Technology, Volume II. Ed. Dr. PIETER HONIG, 567 pp ; 6 × 9¼ in. (Elsevier Publishing Co., Amsterdam.) 1959. Price : 95s. 0d.

This, the second volume of Dr. HONIG's "Principles", is devoted entirely to the subject of crystallization and is indeed a "tour de force". The eleven contributors are internationally known specialists in their chosen fields.

Chapter I is by Mr. H. E. C. POWERS, who has enlisted the collaboration of Dr. A. F. SEAGER. This chapter deals not only with the fundamentals of crystallography in general and sucrose in particular, but is adorned with some of the remarkable photographs for which Mr. POWERS is so well known. The chapter concludes with a section on the inclusion of water and other impurities and is backed up by a bibliography giving brief abstracts of the papers cited. This itself is a departure which could be commended to all authors.

Professor F. H. C. KELLY's chapter on "Solubility of Sucrose in Impure Solutions" discusses methods of determining solubility, multi-component sucrose solutions, the formation of double compounds, phase equilibria and ternary systems with two liquid phases.

Professor A. VANHOOK contributes two chapters, one on "Nucleation in Supersaturated Sugar Solutions", the second on "Kinetics of Crystallization Growth". The first chapter deals with supersolubility and supersaturation, experimental methods in nucleation, and graining in practice. The chapter on kinetics deals with measurements of rate of growth in pure and in impure solutions, the mechanism of growth, and the rôles of diffusion, viscosity and added colloids.

Dr. HONIG has himself made two important contributions, the first a chapter on "Chemistry of Crystallization", the second on "Application of Conductivity as a Control Method in Crystallization".

The first of these chapters deals with decomposition both of sucrose and of reducing sugars during crystallization, the reactions of organic non-sugars, the influence of inorganic non-sugars and the general effect of non-sugars in the crystallization process.

In the second chapter Dr. HONIG discusses the relationship between viscosity and conductivity, specific conductance, supersaturation, viscosity, technical sugar crystallization, the design of electrodes, and application of the method to factory boiling. Low-grade boiling is dealt with at length, and special reference is made to seed grinding and to the preparation of slurries.

Mr. T. R. GILLETT contributes "Control Methods and equipment in sugar crystallization" and writes in sequence on importance of control equipment, basic data and definitions, pan control equipment, measurement of the variables—fluidity and massecuite level, and finally on automatic controls.

For the operating man, this is one of the most interesting chapters in the book, because the practical results of the work done by the Crockett team (E. BERGH, A. HOLVEN, E. C. GILLETT, A. HERNDEN and B. LOTT) have excited the admiration of the sugar world for 20 years.

Professor R. C. L. BOSWORTH of the N.S.W. University of Technology has also contributed two chapters, one on "Heat Transmission as an Indirect Method for the determination of Viscosity and Supersaturation", the second on "Evaporation and Circulation in Crystallization Processes". The first deals with heat transmission under static and dynamic conditions, viscosity, velocity of circulation, and the heat transmission recorder. The second chapter is devoted to a discussion of driving force and resistance, effect of temperature on crystallization and circulation, measurement of circulation in pans and the interpretation of results.

The chapter on "Technology of Sugar Crystallization" is written by the old firm of W. F. Alewijn & P. Honig (well known to readers of the "Archief"). Here are 52 pages of text dealing not only with crystallization but also with important secondary matters such as non-sugar circulation, arrangement of steam paths in calandrias, and minutiae on pan construction, and fittings. There is also a discussion on circulation and its significance, low product crystallization and cooling, control methods and instruments.

Mr. ALFRED WEBRE's contribution is "Natural and Mechanical Circulation in Vacuum Pans with Performance Data and Tests". Mr. WEBRE deals with bore and length of calandria tubes, ring heating surface, the shape of pan bottoms, the guiding of steam in calandrias, natural circulation and observed temperature differences, both local and general. This is followed by a long section on mechanical circulation, of which Mr. WEBRE has been the putative father for the past 25 years. There is a final section on equipment and operating controls for satisfactory pan performance.

On page 397 it is implied that ring calandrias pans produce conglomerated grain. In the reviewer's opinion, this is something of an overstatement. The conglomerates observed in some refined sugar are a result of poor control and excessively rapid boiling. The first ring pans installed in England were built with the express purpose of producing better grain. This they did and they have been uniformly successful in low grade work where the boiling

cannot be hurried. But in the case of white sugar, feverish haste has nullified the intrinsic advantages of the ring heating surface.

Mr. G. C. DE BRUYN has contributed "Crystallization of Massecuite by Cooling". This discusses first—solubility of sugar in pure and in impure solutions, there being a useful collection of the published data. This is followed by rate of crystallization, types of forced coolers, construction of cooling elements, heat transfer coefficients, speed of rotation, power consumption, crystal control and instruments. Finally there is a section dealing with rapid cooling of first boilings and its effect on simplification of the entire boiling system.

Dr. J. H. PAYNE of Honolulu writes on "Conditioning of Massecuite in Crystallizers". After methods of determining the saturation temperature, there is a section on rheology and effect of non-sugar composition, total solids, and temperature on viscosity. Next comes crystal content and size, and the limitations of cooling, reheating and dilution, followed by conductivity control applied to molasses exhaustibility. This to the reviewer is a most useful chapter, because Dr. Payne has assembled, digested and edited a large volume of basic data, which will stand the operating man in good stead.

The final chapter "Maximum Recovery of Crystallized Sucrose from Low Grade Boiling" is by Dr. K. DOUWES DEKKER. He deals first with phase rule considerations in ternary and quaternary systems, estimation of fine grain in molasses, sugar salt compounds, rate of crystallization from impure solutions, and then proceeds to practical exhaustibility and viscosity, reviewing the classical work done by the P.O.J. team, by Micheli & de Gyulay in Australia, and by McCleery in Hawaii.

The author index seems to be adequate, but the subject index could have been larger.

This volume is indispensible reading to any manager, superintendent or technologist who wants better results from his pan work, be he interested in white, raw or low grade.

F. M. CHAPMAN.

* * *

The Gilmore Puerto Rico—Dominican Republic Sugar Manual. Ed. F. I. MEYERS. 188 pp.; 7¾ × 10½ in. (Gilmore Publishing Co. Inc., 525 Audubon Building, New Orleans 16, La., U.S.A.) 1958. Price: $10.00.

There are 37 sugar factories and refineries in Puerto Rico ; 16 sugar factories in the Dominican Republic, and one each in Haiti and the Virgin Islands. The bulk of this volur... as in previous editions, gives detailed information on these factories—personnel, factory and agricultural information, and a tabulated résumé of manufacturing results in 1957 and 1958. A map of the island shows the location of Puerto Rico's factories, while other sections give information on sugar companies owning several factories, addresses and personnel of the Puerto Rican sugar organization ; personnel of the factories of the four areas ; various Puerto Rico, Dominican Republic, U.S. Continental and world sugar production statistics ; a map showing the location of the Dominican Republic factories, and a useful Buyer's Guide featuring the advertisers whose displays appear throughout the book and who are listed in an index. Once again, we have an up-to-date and comprehensive reference book which will not only be valuable to those seeking information on individual companies but also on the areas as a whole.

* * *

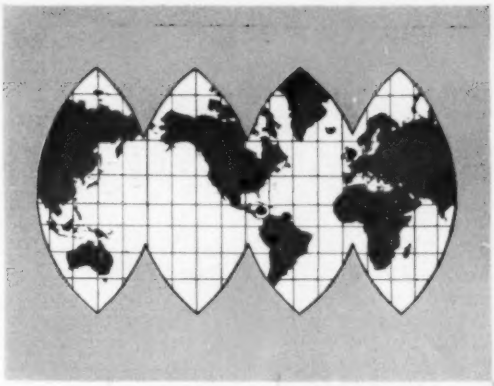
Advances in Carbohydrate Chemistry. Vol. 13. M. L. WOLFROM and R. S. TIPSON. 387 pp.; 5¾ × 9 in. (Academic Press Inc., New York 10, N.Y., U.S.A.: Academic Books Ltd., London.) 1958. Price : $11.00 ; 88s. 0d.

The present volume of "Advances" reviews 10 aspects of the chemistry of the carbohydrates ; each is presented by a specialist and gives many references, some as recent as 1957. The subjects include, "The Lobry De Bruyn—Alberda Van Ekenstein Transformation" which discusses the scope, side reactions, catalysis, use for synthesis, and the mechanism of the reaction. Another article of particular interest to sugar industry readers is that dealing with alkaline degradation of polysaccharides; this refers to many different types of carbohydrate, but would obviously be valuable to provide a basis of knowledge when investigating sugar changes and losses during clarification and evaporation.

* * *

A Comparison of the United Kingdom Tariff and the Proposed Tariff of the European Economic Community. 31 pp ; 8 × 13 in. (Federal Trust for Education and Research, 10 Wyndham Place, London W.1.). 1959. Price : 10s. 0d.

This duplicated report has been made by The Economist Intelligence Unit Ltd., and is intended to describe the similarities and differences between the U.K.'s existing tariff and the E.E.C. tariff as it will be at the end of the transition period, i.e. about 1970/72, when the single external tariff of the Common Market will have been established. It includes a detailed review of tariffs on imports of raw materials and fuels and rather less detailed information concerning tariffs on foodstuffs and manufacturers. In the case of sugar the approximate general tariff on sugar imports in 1956 was 27·8% and 8·4% for preferential imports from the Commonwealth ; this compares with the E.E.C. tariff of about 80% plus internal taxes. Consequently, in the case of sugar as with all the other foodstuffs considered, the E.E.C. rates are so high as to preclude the U.K. raising its tariffs to a level satisfactory to the E.E.C. countries. Thus in the event of Britain's association with these countries, special arrangements would have to be made in respect of these commodities. Comparable figures of U.K. imports from the Commonwealth and other sources in 1956 are also tabulated, with statistics of E.E.C. imports of raw materials.



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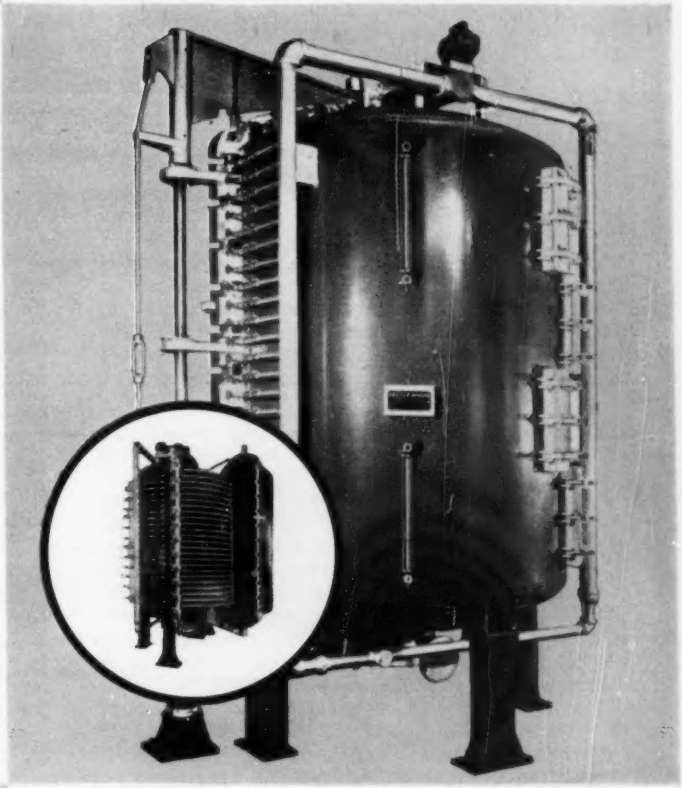

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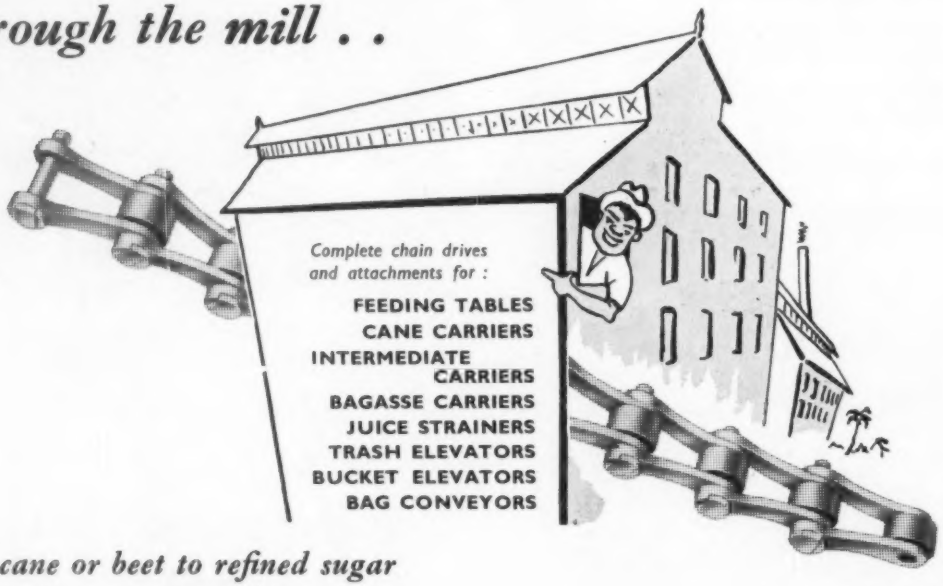

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LABORATORY METHODS AND CHEMICAL REPORTS

Determination of Water in Granulated Sugar. S. HILL and A. G. R. DOBBS. *Analyst*, 1958, **83**, 143–149.—An apparatus is described, in which a 15 g sample of sugar is ground by steel balls in a mechanically-agitated evacuated flask and the water driven off in a thermostatically-controlled heater. After condensing in an evacuated space of known volume, which is then sealed, the water is evaporated and its pressure, and hence amount, measured. The moisture content of granulated sugar (usually about 0·04%) may be determined with a coefficient of variation of less than 1%. The method is compared with others and the distribution of water between the surface and interior of sugar crystals investigated.

* * *

Brix of Final Molasses. S. VIEGO DELGADO. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 111–113.—When a molasses sample is allowed to stand before measuring the Brix by hydrometer, occluded air is released but sediment also separates. Measurements on one sample increased from 81·00 to 86·20 over 100 minutes ; inversion of the sample container to re-suspend the sediment at 120 minutes increased the Brix measurement to 88·05 and settling thereafter caused a decrease to 86·20°Bx again. The value after the inversion is considered to be the true one.

* * *

An Analysis of the Java Ratio. J. ANTONOWITZ. *Proc. 31st Congr. S. African Sugar Tech. Assoc.*, 1957, 39–41.—The Java Ratio method of estimating cane sucrose content is discussed. As the Ratio is a continuously variable function, the method is liable to serious error and is therefore considered unsuitable. In the ensuing discussion the author's views are generally shared and the effect of fibre on the Ratio is mentioned. Determination of the fibre content of cane consignments has been studied, but no suitable method yet found.

* * *

The Composition of South African Final Molasses. K. DOUWES DEKKER. *Proc. 31st Congr. S. African Sugar Tech. Assoc.*, 1957, 92–107.—Analyses are given of final molasses supplied by each Natal factory to the S.M.R.I. Two samples were supplied by each mill, one in July and the other in November. The reducing sugars portion of the non-sugars in the November samples was lower than that in the July samples, the percentages increasing from north to south. The reverse was true of the proteins. Defecation factories showed more wax % non-sugars and more P_2O_5% carbonate ash than the sulphitation factories. Some constituents were better removed by carbonatation than by defecation and sulphitation. Purities of the molasses were determined and compared with target purities calculated by the Douwes Dekker formula and with Hawaiian data. They were found to be unsatisfactorily exhausted when compared with the latter. Purities of the November samples were considerably higher than those of the July samples. Graphs and tables of results are given and the methods used in the analyses are described. Good agreement was found between the Jackson & Gillis and the Eynon & Lane methods.

* * *

Hydrolysis of Sucrose by Hydrochloric Acid and by Sulphonate or Carboxylic Cation Exchangers. P. L. DEVILLERS and M. LOILIER. *Ind. Alim. Agric.*, 1958, **75**, 465–470.—In a study of sucrose inversion by HCl and by cation exchangers[1] it was found that the inversion of sucrose at 20°C and up to a concentration of 40 g/100 ml by a strong acid (in this case, 0·13 *N* HCl) is in close agreement with the values calculated by the ANDERSSON formula

$$\log p = 18{\cdot}68 - \mathrm{pH} + \log t - \frac{5{\cdot}580}{T}$$

where p = % sucrose hydrolysed, t = time in min, and T = absolute temperature. Above a concentration of 30% the rate of hydrolysis is less than that indicated by the formula and it levels out at 4·6%/hr. Sucrose hydrolysis by a polystyrene sulphonate cation exchanger at a concentration of 1/3 of the resin by volume is equivalent to that caused by a *N*/10 solution of strong acid, and can be calculated from an adaptation of the above formula while the sucrose concentration remains below 40%. A temperature increase of 10° increases the hydrolysis rate by 4·4 times. The effect of the various sulphonate exchangers was practically identical, while the carboxylic exchanger "Amberlite IRC 50" caused no hydrolysis. The effect of the acid and sulphonate exchanger are additive, and inversion in an impure sugar solution will be caused not only by a lowering in the pH of the solution but also by the exchanger itself. To limit hydrolysis when treating juices in cation exchangers it is considered necessary to pass the juice very quickly through the column at a low temperature and treat dilute molasses rather than 2nd carbonatation juice. The use of the hydrolysing action of the exchangers to prepare invert syrups is mentioned.

* * *

Polarimetric Determination of Sugar Content. J. DOBRZYCKI. *Gaz. Cukr.*, 1958, **60**, 181–184.—Preparation of the sugar solution for polarization, setting of the polarimeter and the most common sources of error are dealt with in detail.

[1] *See also I.S.J.*, 1958, **60**, 80.

BY-PRODUCTS

A Pilot Plant for Mixing Molasses with Bagasse. A. G. CLAIRE. *Proc. 25th Conf. Queensland Soc. Sugar Cane Tech.*, 1958, 103–108.—The pilot plant developed at Fairymead comprises a dryer for reduction of the moisture content of bagasse to 12%, at a rate of 90 lb of wet bagasse per hour ; a rotary screen ; a unit to give a 70 : 30 mixture of cold molasses with screened bagasse (through ½-in mesh) ; a unit to give a constant metered flow of bagasse and a unit to supply and control the flow of molasses. Some 12 tons of mixture has been prepared for feed trials.

* * *

Combining Aromatics with Carbohydrates. ANON. *Chem. Processing*, 1958, **4**, (7), 4–5.—An account is given of a new method of condensing carbohydrates, including sugar, with aromatic organic compounds such as toluene, phenol, dodecyl benzene, etc. The two materials are contacted with anhydrous hydrogen fluoride, sometimes in the presence of an inert solvent such as pentane, and the reaction carried out in an autoclave over a period varying from a few minutes to 20 hours. The HF is removed from the product either by sweeping out with a stream of nitrogen or by adding ice to separate the insoluble organic material. The product is purified by solvent extraction. The resulting compounds are claimed to have potential uses in many industries—pharmaceuticals, detergents, plastics, etc.

* * *

The Economic Basis for Utilization of Bagasse. L. F. MARTIN. *Sugar y Azúcar*, 1958, **53**, (6), 32–33, 38.—The use of bagasse for manufacture of such products as hardboard, paper, furfural, etc. is discussed from the economics viewpoint. It is emphasized that the economics of a process which is considered feasible after laboratory experiments should be thoroughly analysed. Accurate estimation of the amount of available surplus bagasse is considered as well as the importance of length of season, handling costs, which are much higher than those of the material leaving the factory, and the cost of converting the bagasse into the finished product. It is pointed out that less than 5% of over 15 million tons of cane fibre produced in the Western Hemisphere is used industrially.

* * *

Paramonga Finds Diversification Profitable. ANON. *Sugar J.* (La.), 1958, **21**, (1), 10–13.—Hacienda Paramonga, a Peruvian sugar factory of 1700 tons daily grinding capacity owned by W. R. Grace & Co., is described and the cane agriculture at Paramonga and in Peru generally is discussed. Of the bagasse from the factory, 70% is converted into paper of all types at the paper-mill erected on the plantation in 1938/39. Annual production, after the installation of a third paper machine, will be 30,000 metric tons. Caustic soda for the paper-mill is produced on the plantation from crude salt bought from a nearby deposit. The chlorine and hydrogen formed with the soda by electrolysis of the brine is combined to give HCl, of which 650 tons is sold annually to Paramonga and Cartavio sugar factories and to 4 textile mills, all owned by the same company. The excess chlorine gas not used for bleaching or HCl production is liquefied and sold for water purification to various towns in Peru and Ecudaor. Among other products manufactured at the hacienda are ethyl chloride, produced by combining HCl with alcohol from the distillery, and muriatic acid.

* * *

Process for Separating Waxes and Gums in the Sugar Industry. S. GONZÁLEZ ECHAZÁBAL. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 219–228.—A process is described whereby clarifier muds are passed into a chamber which is connected to a vacuum pump and a condenser. Flash evaporation reduces the temperature from 190° to 130°F and the muds are concentrated, partly by loss of water and partly by loss of entrained air. The waxes, solidified on cooling, are retained by the rotary filter instead of passing through ; hence, recovery increases from 15% to 60% of that entering the factory. In addition the smaller amount of wax in the filtered juice gives a better sugar.

* * *

Production of Green Sugar. R. GÓMEZ ALVAREZ. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 237–241.—Green sugar is an adulterated raw sugar of $\leq$ 96 pol, containing 0·02% cane fibre, 2·00% NaCl and a green dye, such that it is not fit for human consumption but is suitable as an animal feed. The process for its manufacture is described ; it is prepared as a normal raw sugar of at least 97·5 pol and the dye added in the centrifugal. The salt and fibre are added on discharging the centrifugal. The molasses produced is not appreciably different from that of a normal raw sugar molasses and is suitable for use in distilleries.

* * *

Surplus Sucrose in Oilwell Drilling. W. L. OWEN. *Sugar y Azúcar*. 1958, **53**, (2), 44–45.—The various applications of dextran and other fermentation gums from sucrose, e.g. as a retardant for loss of water from drilling fluids in oilwell drilling, are reviewed.

* * *

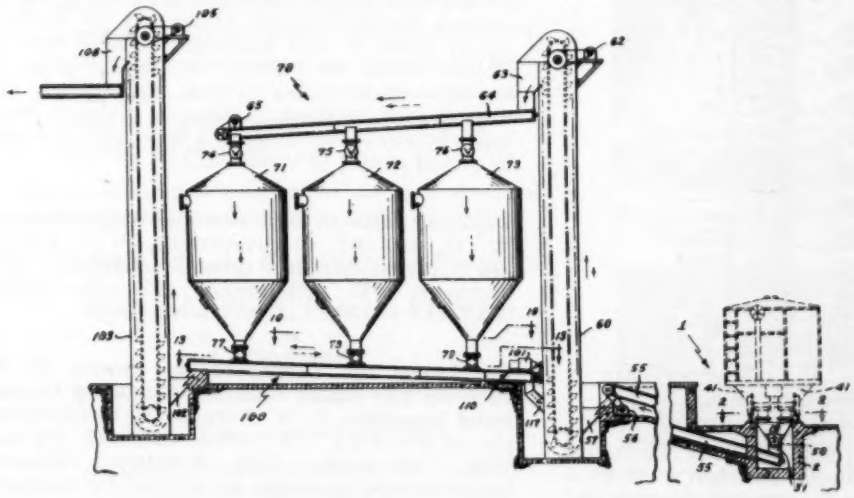
Improvement of Distillery Yeast by Re-Fermentation. G. T. REICH. *Mem. XXX Conf. Asoc. Técn. Azuc. Cuba*, 1956, 411–418.—A process is described whereby a yeast fermentation is carried out with treated molasses and the yeast separated for reactivation by a second aerobic fermentation with fresh molasses. The original quantity (e.g. 500 lb) is returned for further fermentation, the same quantity is returned to the re-fermentation, and the bulk (8000–10,000 lb) is dried for use as human or animal food yeast. The re-fermentation improves the quality of the dried yeast obtained as regards colour, protein content and vitamin content, while no more alcohol is produced than with the other yeast production fermentations.

UNITED STATES

Handling (Bulk) Sugar. J. CORRIGAN, assr. J. C. CORRIGAN CO. INC., of Dorchester, Mass., U.S.A. **2,856,083.** 14th October, 1954; 14th October, 1958.—The loading, storage and recirculating system in general comprises a sealed unloading unit 1 whose foundation or pit 2 contains receiving hoppers 10 and means for sealed coupling of the car to be unloaded to the hoppers. The material being unloaded from the car is gravity-fed through hoppers 10 to spiral conveyor 50 contained in a suitably sealed housing and located in pit 2. From outlet 51 of conveyor 50 the material is fed to the sloping spiral conveyor 55 from which it drops through chute 57 to the loading bucket elevator 60. From bucket elevator 60 the material drops through chute 63 to spiral conveyor 64 and thus enters the storage and recirculating system 70. The storage bins 71, 72, 73 have valves 74, 75, 76 respectively, which individually control the flow of material from conveyor 64 into the storage bins. Thus the flow of material to one or more storage bins may be controlled as desired.

By means of the rotary vane feeders 77, 78, 79 conveniently placed beneath storage bins 71, 72, 73 respectively, the stored material is controllably fed to spiral conveyor unit 100. If direct feeding of the material to processing equipment is desired the rotation of spiral conveyor unit 100 is such that the conveyor unit transports the material to chute 102 through which it drops to bucket elevator 103. By means of bucket elevator 103 the material is then transported to chute 106 through which it drops to a conveying system and thence to process.

If operation of the lump-breaking and recirculation features of this system is desired, the rotation of spiral conveyor unit 100 is reversed so that it carries the material toward the breaker unit 110. As the material passes through lumps or caked portions of the material are disintegrated by a system of kicker vanes and breaker paddles. The material emerging from breaker unit 110 drops through chute 117 and enters loading bucket elevator 60 which, in turn, carries the material back to the chute 63 and thence to the storage and recirculation system 70.



* * *

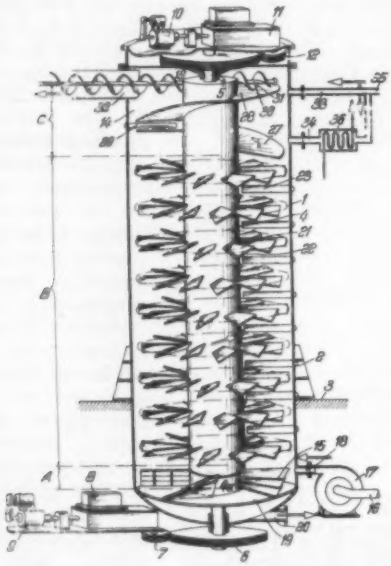
Utilization of Pith in the Manufacture of Pulp. C. BIRDSEYE, assr. PROCESS EVALUATION AND DEVELOPMENT CORP., of New York, N.Y., U.S.A. **2,862,814.** 9th March 1955; 2nd December 1958.—Bagasse (or other Gramineae plant material) is separated into sclerenchymatous (long fibre) and parenchymatous (short fibre and pith) fractions. The fractions are digested under steam pressure greater than atmospheric, the latter for a shorter time (about ½ min), while treating with chemical digesting agents of progressively weaker strength. The digested fractions are mixed while still under pressure, and the mixture comminuted mechanically. Before the parenchymatous fractions is added to the digesting sclerenchymatous fraction, it is wetted with spent "black liquor" at 60°C to a moisture content of 60–80%, thereby reducing the amount of digesting material absorbed by the pith. If the bagasse is separated into three fractions, the short fibre fraction is added to the digestion chamber at a time intermediate between adding the long fibre and pith fractions.

Copies of Specifications of United Kingdom Patents can be obtained on application to H.M. Patent Office, 25 Southampton Buildings, London, W.C.2. (price 3s. 6d. each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. (price 25 cents each).

Sugar Refining with Magnesium Carbonate Polyhydrate from Recarbonated Dolomite, Magnesite and the Like. A. M. ZENZES, of New York, N.Y., U.S.A. **2,856,319**. 20th January 1954 ; 14th October 1958.—Lime is added to a sugar solution to give a pH of about 12, CO_2 is added to give a pH of 10–11·2 (when the precipitate may be removed), and reactive magnesium carbonate trihydrate is added until the pH is reduced to at least 9·6. The mixture is agitated at 60–80°C until substantial decolorization is effected, and the precipitate is then removed. Alternatively, the decolorized solution may be limed to pH 10.2–10·4, precipitating the dissolved magnesium and $Mg(OH)_2$, and this removed, followed by carbonatation.

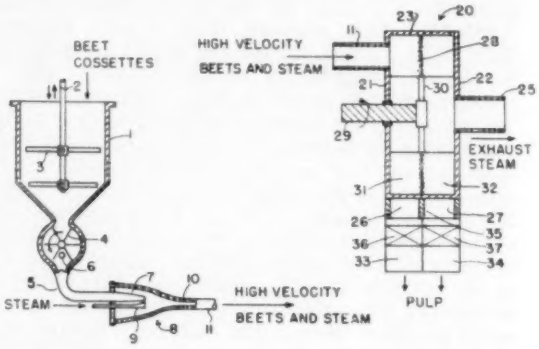
* * *

Beet Diffuser. W. KAETHER and F. MUSHACK, assrs. BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT, of Braunschweig, Germany. **2,857,907**. 7th February 1957 ; 28th October 1958.—The shaft 4 of the tower diffuser 1 is in two parts, the upper turned by electric motor 10 by way of gearing 11, 12, 13, while the lower part 4a is turned by motor 9 by way of gearing 6, 7, 8. The tower is divided into three zones A, B and C. Zone A is the stirring zone where beet cossettes are supplied by pump 17 and distributed evenly and raised by means of the overlapping blades 15. Juice



leaves zone A by passing through screen 19 and pipe 20. In the extraction zone B the shaft 4 carries a number of rings of vanes 21, mounted obliquely and stepwise in relation to subsequent rings. The rings are separated by spaces into which the guide plates 23 extend. The vanes 21 may be flat plates as shown or may have curved reinforcing plates welded to their underside, giving a pointed oval hollow section. Cossettes carried to the discharging zone C are conveyed by the scrolls 27, 28 and guide plate 29 to the discharging worm conveyor 30, 31, 32. Water is admitted to the tower through pipes 33, 34, the lower having a heating device 36.

Machine for Pulping Sugar Beets. L. E. BROWNELL and S. A. ZIEMINSKI. assrs. U.S. SECRETARY OF AGRICULTURE. **2,858,079**. 6th June 1957 ; 28th October 1958.—Beet cossettes are kept in motion in the hopper 1 by stirrer 2 and are directed by impeller 4 into pipe 5. This connects with the inlet chamber 7 of ejector 8. High pressure steam entering through 9 causes a negative pressure in chamber 7 so that cossettes are drawn into the ejector and pass through constriction 10 into pipe 11 as a high-speed mixture with the steam. Passage is so rapid that no



deterioration of the beet occurs and very little condensation of steam. The steam enters the disintegration chamber 20 which is cylindrical and is provided with a driven shaft 29 carrying a spider 30 and annular perforated baffle 28. The cossettes from pipe 11 hit the baffle and are disintegrated into pulp, passing through the perforations, where they are scooped up by blade 32 and discharged through exit 34. Coarser pieces not passing through the screen 28 are removed by blades 31 and discharged at 35 ; they may be recycled if required. Exhaust steam leaves by way of vent 25 under a back pressure caused by partial closing of valves 36, 37.

* * *

Depolymerization of High Molecular Weight Dextran. W. D. BELLAMY, of Schenectady, N.Y., U.S.A., assr. GENERAL ELECTRIC COMPANY. **2,867,571**. 30th September 1953 ; 6th January 1959.—See U.K.P. 764,547.[1]

* * *

Clarification and Demineralization Process for B-Molasses and Similar Materials Containing Concentrated Impurities. E. W. KOPKE, assr. ULTRA-SUCRO CO., of New York, N.Y., U.S.A. **2,868,677**. 3rd July 1956 ; 13th January 1959.—B-molasses, affination liquors or similar syrups are clarified by treatment with basic and acidic reagents to give a pH of 6·7–6·9, adding a flocculating medium, and removing the insolubles ; the product is passed through a bed of high-porosity, highly-ionized sulphonated styrene-divinyl benzene copolymer resin, the excluded impurity-containing effluent is collected, and sugar rinsed out of the bed with water. The first fraction of the latter may be recycled, and the molasses may be diluted to 40–50° Bx before clarification.

[1] *I.S.J.*, 1957, **59**, 228.

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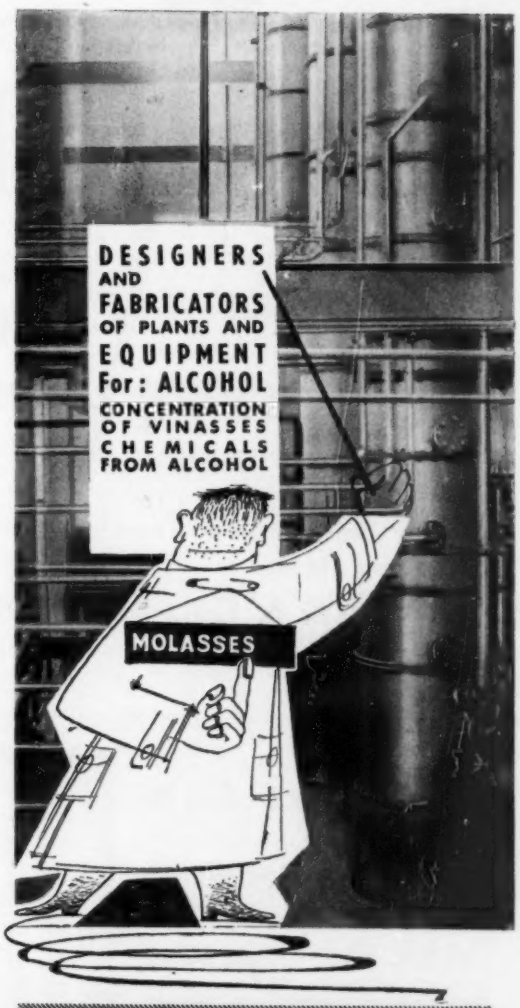

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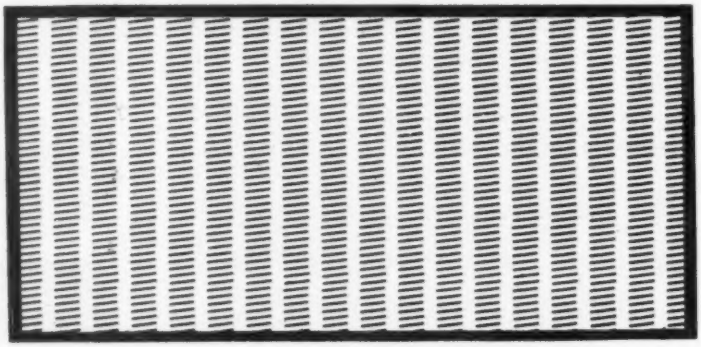

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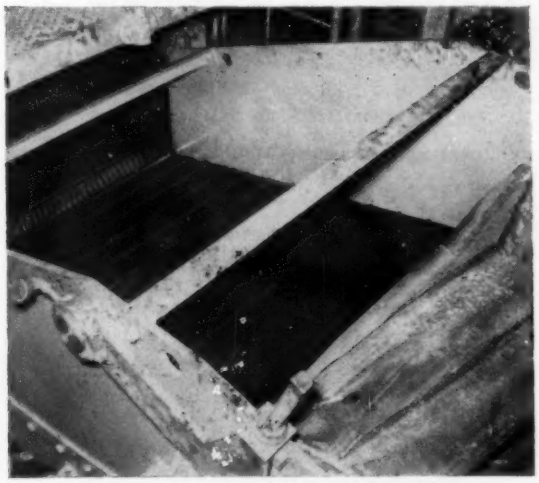
TRADE NOTICES

Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

Rubber Belt Carriers for the New Swaziland Mill. Farrel-Birmingham Company, Inc., Ansonia, Conn., U.S.A.

Farrel rubber-belt intermediate carriers will be installed in the sugar mill now being built by George Fletcher & Co. Ltd., of Derby, for the new factory at Eranchi, Swaziland, South Africa, owned by Sir J. L. Hulett & Sons Ltd. This is the first use of this patented device outside of the Western Hemisphere where these multi-ply, endless belts have gained an impressive reputation for maintenance-free operation since the first one was placed in service nearly six years ago.



The Swaziland mill is the second new mill to be completely equipped with these rubber-belt carriers, the first being the Farrel tandem installed at Central Romana, Dominican Republic, in the early part of 1958. At a number of other locations in Cuba, Puerto Rico and Mexico, single units were first installed for trial, and others have since been added.

The first installation of a Farrel rubber-belt intermediate carrier was made in February, 1953, at Central Plata, Puerto Rico. This original belt has required no maintenance and, although there is evidence of some wear, it is still in service after having carried approximately 2½ million tons of cane.

Besides having immunity to breakage and qualities for long wear, these Farrel carriers have been reported to have greater force-feeding action and to provide better retention of both bagasse and imbibition.

The carrier is a complete unit, interchangeable with chain-and-slat carrier, and the entire changeover can be accomplished during a short shutdown.

PUBLICATIONS RECEIVED

"ROTORK" ELECTRIC ACTUATORS FOR VALVE CONTROL. Rotork Engineering Co. Ltd., Widcombe Manor, Bath, Somerset.

A new leaflet describes the "Rotork" method of direct application of electrical power for remote control of pipeline valves. They save labour costs; are designed to run for 10–20 years with no attention other than annual greasing and checking of the oil level ; eliminate human fallibility, and give appreciable saving in time of operation.

* * *

TIMERS, DELAY SWITCHES AND SEQUENCE CONTROL PANELS. Elcontrol Ltd., Wilbury Way, Hitchin, Herts.

A new data sheet, No. TR2., describes the Elcontrol range of standard electronic process timers, cyclic timers and delay switches, with simplified descriptions and a table of characteristics. The interest of the manufacturers in producing complete sequence control panels for specific requirements is emphasized.

* * *

BUILDINGS. Coseley Buildings Ltd., Lanesfield, Wolverhampton.

Two new plentifully illustrated booklets describe, respectively, steel-framed buildings and frameless aluminium buildings. The first emphasizes the speed of erection and space economy of the buildings, and gives details of the sizes available for standard units, doors, windows, foundations, sheeting, colours, insulation, ventilation, building details, roofs, and design data. Examples are given of their use in industrial applications for factories, stores, workshops, offices, and also for living accommodation. The "Kingstrand" aluminium housing is built up from 2-room or 4-room basic units, and may be extended as desired. They too can be used for a wide variety of purposes, and details are given of their construction, design, erection, etc.

* * *

APV PARAFLOW PLATE HEAT EXCHANGER. A.P.V. Co. Ltd., Manor Royal, Crawley, Sussex.

A new leaflet describes and illustrates the principle of the "Paraflow" heat exchanger and lists its advantages—high heat transfer rate, space saving, accessibility of surfaces, flexibility, etc. The types of exchanger are illustrated and catalogued, and photographs show applications in a wide variety of industries and fluids.

* * *

ROTAMETER FLOW RATE TRANSMITTERS. Brooks Rotameter Company, Box 432, Lansdale, Pennsylvania, U.S.A.

A new Bulletin, No. 170, describes and illustrates the MPT series of transmitting extensions for use with the basic Rotameter design, including the MPT-51 magnetic position converter, the MPT-50 pneumatic and MPT-52 electric transmitter, and MPT-53 integrator.

* * *

BOILER EQUIPMENT AND PUMPS. G. & J. Weir & Co. Ltd., Cathcart, Glasgow S.4.; Drysdale & Co. Ltd., Yoker, Glasgow.

A series of leaflets describe the wide range of Weir boiler feed pumps, heaters and regulators, boiler circulators, and automatic steam controllers, as well as the many pumps produced by Drysdale & Co. Ltd., an associate company.

FREE MARKET REQUIREMENTS FOR 1959

INTERNATIONAL SUGAR COUNCIL ESTIMATES[1]

The following estimate was made by the International Sugar Council on 25th February, 1959, as referred to on page 97 of this issue.

COUNTRY OR AREA—		*Total Requirements (in thousands of metric tons raw value)*
UNITED KINGDOM and BRITISH COMMONWEALTH (excluding Pakistan)—		
Parties to Commonwealth Sugar Agreement—		
United Kingdom (total consumption)	2,800	
New Zealand (partial import requirements)	75	
Federation of Rhodesia and Nyasaland (partial import requirements)	45	
	—	2,920
Commonwealth Countries not parties to Commonwealth Sugar Agreement—		
Aden and Aden Protectorate	25	
Bahamas and Bermuda	5	
British East Africa (Kenya, Uganda, Tanganyika)	40	
British North Borneo	10	
British Somaliland	10	
Canada (total consumption including sugar equivalent of fancy molasses)	800	
Ceylon	160	
Channel Islands	5	
Cyprus	20	
Gambia and Sierra Leone	15	
Ghana	40	
Gibraltar	5	
Hong Kong	60	
Federation of Malaya	150	
Malta	10	
New Zealand (balance of import requirements)	35	
Nigeria	65	
Federation of Rhodesia and Nyasaland (balance of import requirements)	15	
Sarawak and Brunei	15	
Singapore	100	
Zanzibar and Pemba	5	
	—	1,590
		4,510
		Estimated Supplies Available
Canada (production)	170	
United Kingdom (production)	800	
British Dependent Territories (exports)		
Australia (exports)	2,540	
Union of South Africa (exports)		
	—	3,510
Estimated Requirements of the Free Market		1,000

FRANCE, FRENCH OVERSEAS DEPARTMENTS AND TERRITORIES and SAAR—	*Production*	*Consumption*	
Metropolitan France and Saar	1,560	1,460	
French Overseas Departments and Territories which do not import sugar—			
Martinique, Guadeloupe, Réunion, Madagascar	450	50	
French Overseas Departments and Territories which import sugar—			
Africa, excluding Algeria	5	140	
Algeria	1	240	
Other territories	—	5	
	2,016	1,885	
Estimated requirements from free market			0
Carried forward			1,000

[1] *I.S.C. Stat. Bull.*, 1959, **18**, (3), 72–74.

ESTIMATE OF FREE MARKET REQUIREMENTS FOR THE CALENDAR YEAR 1959—*continued*

Brought forward		1,000
COUNTRY OR AREA—		
EUROPE (excluding United Kingdom and France)—		
Austria	10	
Eire	65	
Finland	150	
Germany (West)	200	
Greece	100	
Iceland	10	
Norway	150	
Spain	80	
Sweden	75	
Switzerland	220	
Yugoslavia	140	
		1,200
AMERICA—		
Bolivia	50	
Chile	220	
Colombia	30	
Honduras	10	
Uruguay	100	
Venezuela	35	
		445
AFRICA (other than British Commonwealth Countries and French Overseas Departments and Territories)—		
Canary Islands	10	
Libya	15	
Morocco	375	
Sudan	100	
Tunisia	75	
United Arab Republic (Southern Region)	65	
		640
ASIA (other than British Commonwealth Countries)—		
Afghanistan	25	
Burma	25	
Cambodia	10	
China (Mainland)	150	
Iran	255	
Iraq	150	
Israel	55	
Japan	1,150	
Jordan	30	
Korea	60	
Laos	5	
Lebanon	30	
Mongolia	5	
Pakistan	60	
Saudi Arabia and neighbouring Red Sea Territories	70	
Thailand	10	
United Arab Republic (Syrian Region)	50	
Vietnam	40	
OCEANIA (excluding New Zealand)		
Polynesia, Oceania, Micronesia	5	
		2,185
		5,470
Allowance (2 per cent) for possible underestimates and non-statistical consumption		110
		5,580

Indonesian Nationalization of Dutch Properties. The Indonesian Government has decided to nationalize all former Dutch properties in the country, the Indonesian Minister of Agriculture announced in February. The claims for compensation are to be regulated by a special law, but payment is to depend on the cession of Dutch New Guinea to Indonesia.

* * *

Top Borer Control in India.[1]—Top borer damage in India is responsible for an estimated annual loss of 20% of the cane crop. The Sugarcane Research Laboratory, Lucknow, has undertaken field tests using the parasite *Melwa Arnetipenis* on a farm with a heavy infestation of the top borer caterpillars. The larvae were introduced in March 1958, and by the end of October, nearly 70% of the borers had been destroyed.

Factories for Sudan[2].—It is proposed to erect two sugar factories in the Sudan, German and Czechoslovakian factories taking part. The factories will be of 52,000 and 50,000 tons capacity, and will cost 700,000 and 500,000 Sudanese pounds respectively.

* * *

New Sugar Factory for Israel[3].—Erection of a third sugar factory should soon be started in Kirjat Gat, in Israel. It will have a capacity of 16,000 tons of sugar per year, to be expanded later to 35–40,000 tons. The other two factories, at Afula and Ramat Gan, produce about 9000 and 3000 tons respectively, per campaign.

[1] *Indian Sugar*, 1958, **8**, 489–490.
[2] *Zeitsch. Zuckerind.*, 1959, **84**, 105.
[3] *Zeitsch. Zuckerind.*, 1959, **84**, 105.

BREVITIES

Swiss Beet Production, 1958–59[1].—Aarberg sugar factory and refinery produced sugar from 282,000 tons of beet in 1958–59, compared with 244,741 tons in the previous campaign.

* * *

Sugar and Soft Drinks.—A report by the U.K. Food Standards Committee recommends that soft drinks should be sweetened wholly with sugar or other carbohydrate sweetening matter and that the use of saccharin or other artificial sweetening agent should be prohibited. In addition, it is the opinion of the Committee that no soft drink on sale at present contains sufficient carbohydrate to justify special claims relating to energy value ; a special standard for glucose beverages is not justified and the use of the term "glucose" should not be permitted in connexion with the labelling or advertising of soft drinks.

* * *

Cane Mill Contract for Australia[2].—An association of two Queensland engineering firms, Walkers Ltd. of Maryborough and Bundaberg Foundry Co. Ltd., with a New South Wales firm, have secured a contract worth £A100,000 to supply a new crushing unit for one of South Africa's largest mills. The unit will have a capacity of 200 t.c.h. and incorporates a mill of unique design which underwent a full season's trials in Queensland. The advanced design, as well as the price, was instrumental in successfully obtaining the order.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 17th March* 1959)

Anglo-Ceylon (5s)	17/1½
Antigua Sugar Factory (£1)	15/6
Booker Bros. (10s)	26/–
British Sugar Corp. (Ltd. (£1)	20/3
Caroni Ord. (2s)	5/9
Caroni 6% Cum. Pref. (£1)	17/3
Distillers Co. Ltd. (6s. 8d units)	25/6
Gledhow Chaka's Kraal (£1)	68/9
Hulett & Sons (£1)	88/–
Jamaica Sugar Estates Ltd. (5s units)	7/–
Leach's Argentine (10s units)	13/–
Reynolds Bros. (£1)	55/–
St. Kitts (London) Ltd. (£1)	56/3
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United Fruit Co.	42¼
West Indies Sugar Corp. ($1)	50½

New Siamese White Sugar Factory[3].—It is planned to erect a white sugar factory in Thailand.

* * *

New Jugoslavian Factory[4].—A new beet sugar factory is to be built in Ludbreg, near Varazdin. It will be situated in a farming area with a large surplus of labour.

* * *

New Polish Sugar Factory[5].—A new factory is under construction at Ostrowice in the district of Bydgoszcz which will be ready for working in 1963, and will probably have a daily capacity of 1400 tons[6].

* * *

New Bulgarian Factory[7].—A new factory is proposed for the neighbourhood of Lom. It will have a slicing capacity of 1500 tons per day and will have a sugar store for 15,000 tons. Part of the equipment has already been supplied from East Germany, and the factory will be finished in 1960.

* * *

New Lebanese Factory/Refinery[8].—In the Bekaa region, about 60 kilometres east of Beirut, a German firm is building the first sugar factory in the Lebanon. It will process beets grown in the fertile area between the Lebanon and anti-Lebanon, and will also refine imported raws, producing about 10,000 tons of sugar per year.

* * *

Refined Sugar Terminal Market in France[9].—First negotiations for establishing a terminal market for refined sugar in Paris have taken place between representatives of trade, sugar beet growers, sugar factories and sugar refineries. The plans are to be submitted to the Government, as soon as an agreement has been reached between the various interested groups. The business is to be based on white crystallized sugar No. 3 as before the last war.

* * *

Sugar Production in China[10].—Total sugar production in 1958 from beet and cane on the Chinese Mainland is estimated at about 1,300,000 tons, according to "Die Wirtschaft des Ostblocks", which is an increase of about 62% above the 1957 figure. The greatest increase has been in Kwangtung province where the production of cane was doubled, and the number of factories increased by 12 to 95. A sugar factory delivered from Poland started crushing in late December. With a capacity of 3000 tons of cane per day, it is the largest factory in China.

* * *

Argentina Sugar Production, 1958[11].—Total sugar production in Argentina during the 1958 crop was 1,013,408 metric tons, produced from 11,948,977 tons of cane. It included 212,976 tons of *pilé*, 424,417 tons of 1st quality granulated, 362,358 tons of 2nd quality granulated and the remainder low-product. Of the total, 722,099 tons were produced in Tucumán, 164,304 tons in Jujuy, 69,069 in Salta, 43,007 in Santa Fé, and 14,928 tons in Chaco. The sugar yield compares with 656,963 tons in 1957 and the record of 777,840 tons in 1954.

---

[1] *Zeitsch. Zuckerind.*, 1959, **84**, 105.
[2] *Queensland News Letter*, 5th March, 1959.
[3] F. O. Licht, *International Sugar Report*, 1958, **90**, (Supp. 23), 14.
[4] F. O. Licht, *International Sugar Report*, 1959, **91**, (Supp.1), 8.
[5] F. O. Licht, *International Sugar Report*, 1958, **90**, (Supp. 22), 8.
[6] *Zeitsch. Zuckerind.*, 1958, **83**, 562.
[7] *Sucr. Belge*, 1959, **78**, 265.
[8] *Zeitsch. Zuckerind.*, 1959, **84**, 105.
[9] F. O. Licht, *International Sugar Report*, 1959, **91**, (Supp. 4), 51.
[10] F. O. Licht, *International Sugar Report*, 1959, **91**, (2), 28.
[11] *La Industria Azucarera*, 1958, **64**, 606–607; 1959, **64**, 3.

Photo showing a portion of the G-8 48" automatic white and intermediate sugar centrifugals at Spreckels Sugar Company, Spreckels, California.

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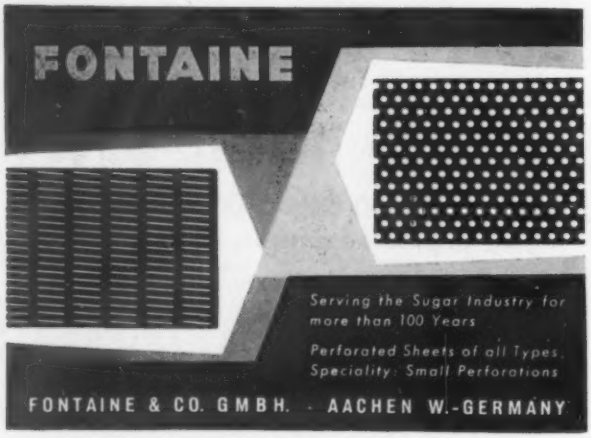
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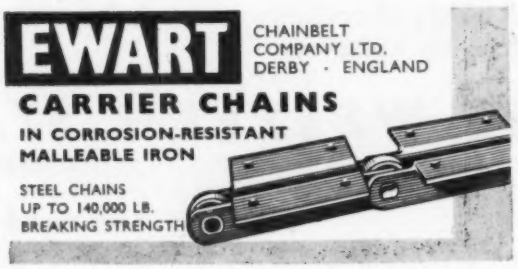

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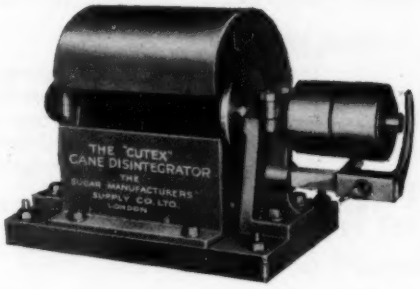

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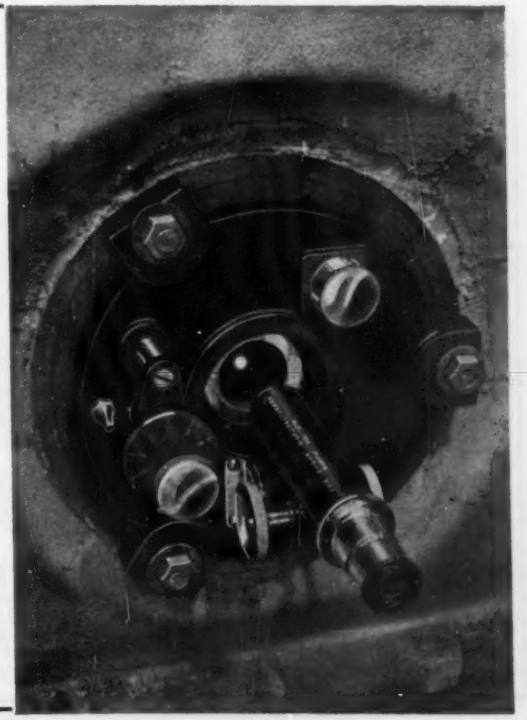

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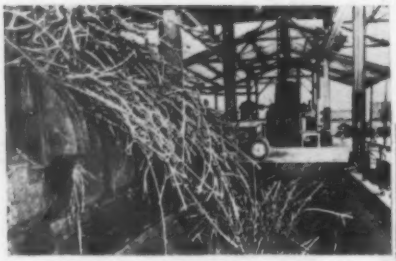

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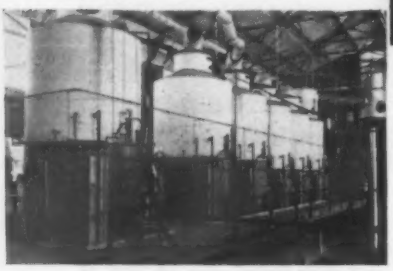

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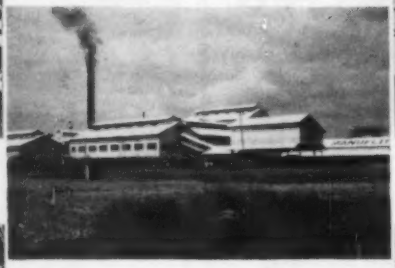

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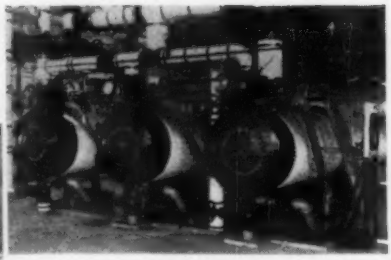

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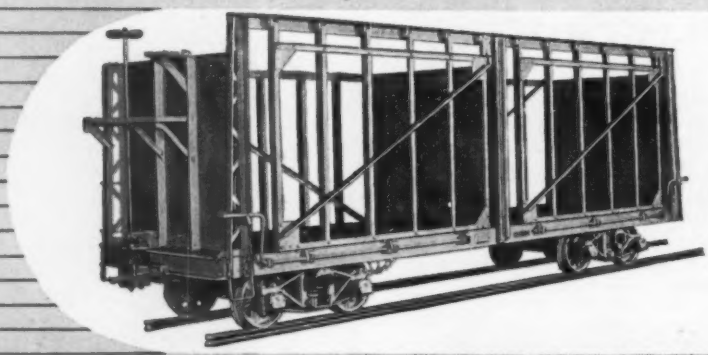

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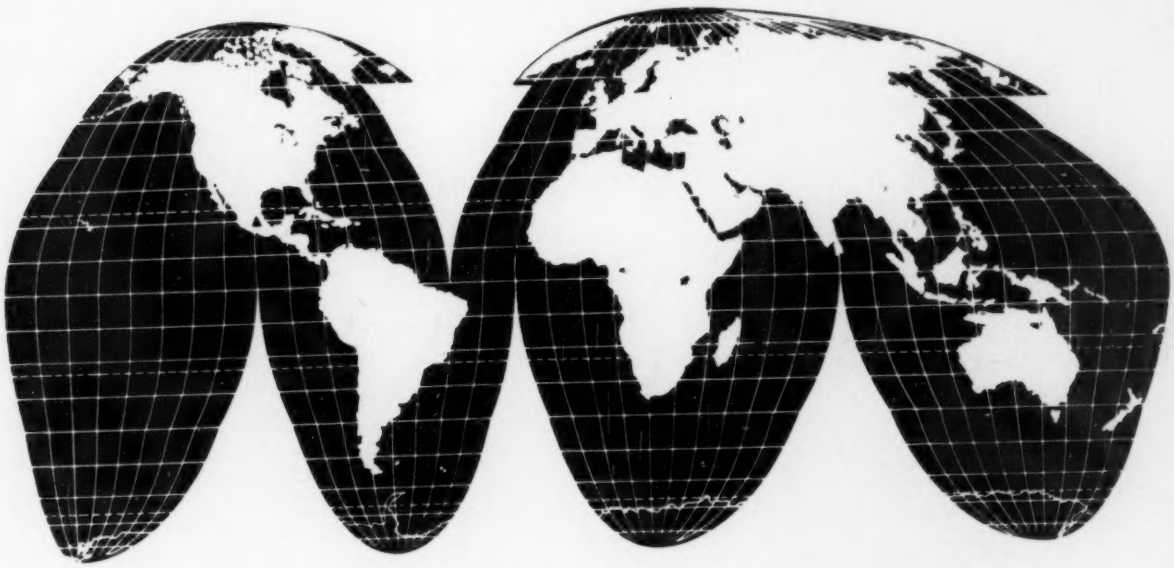

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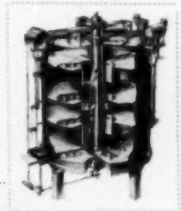

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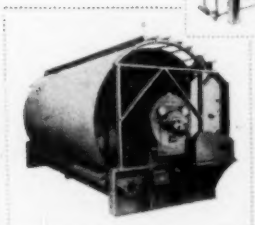

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